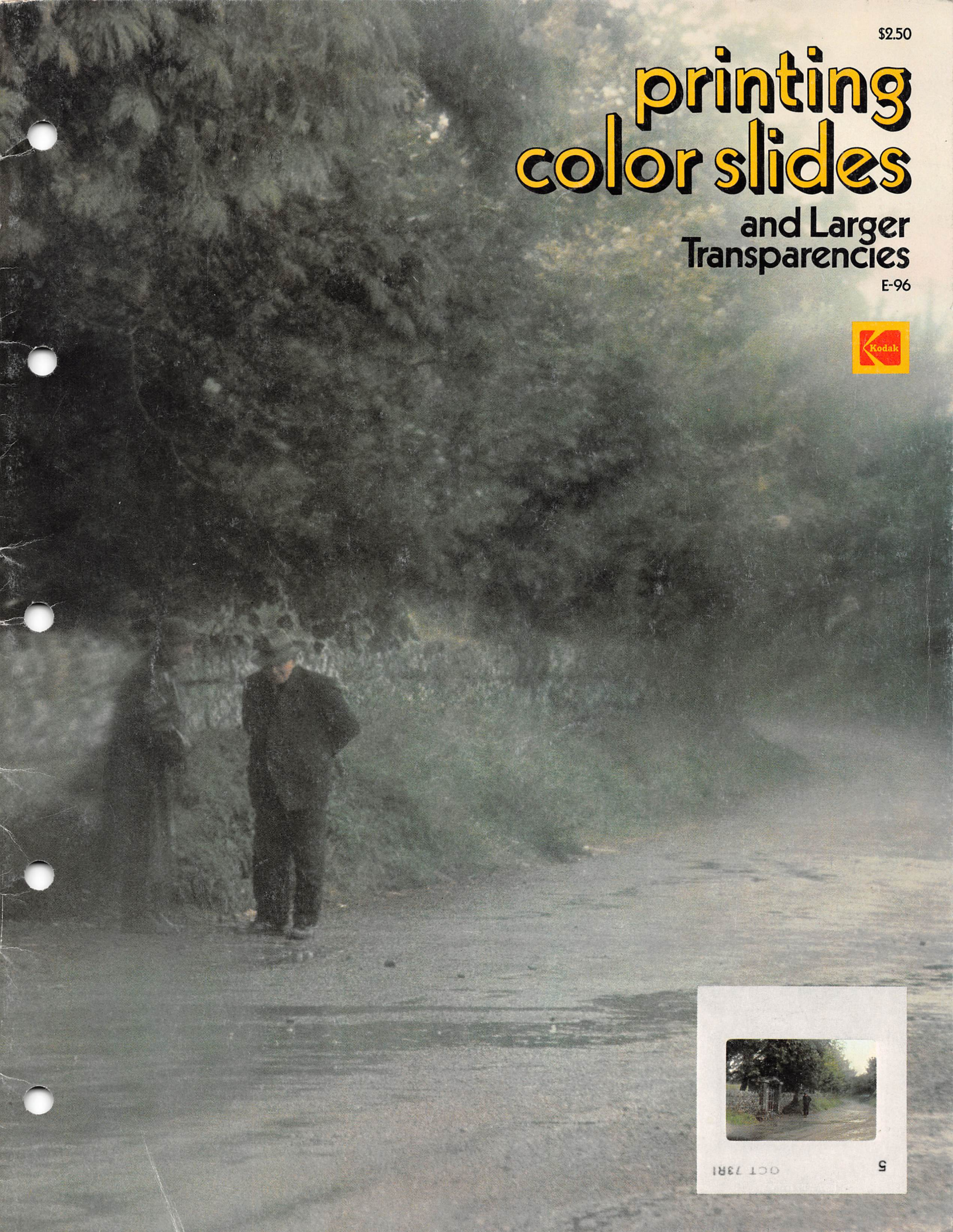
$2.50

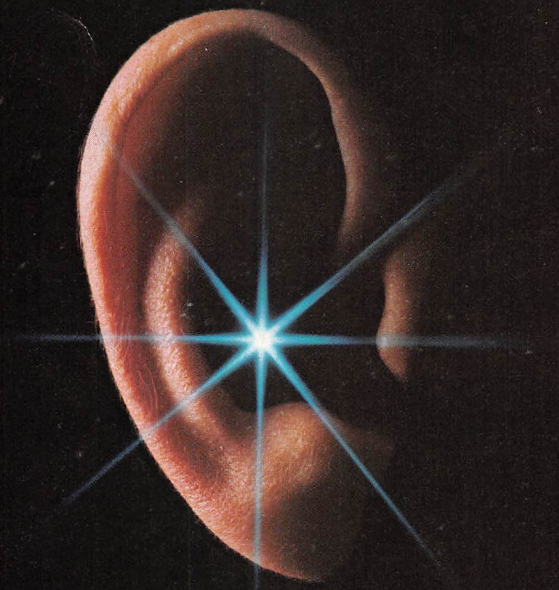
printing color slides

and Larger Transparencies

E-96



Kodak introduces talking instructions on how to process your own negatives, slides, and color or black-and-white prints.



LISTEN
to KODEWORD™ Cassettes.

KODEWORD—Kodak's new Darkroom Audio Cassette program is a do-it-yourself, step-by-step, second-by-second series of tapes (plus printed instructions) on darkroom processing.

Now you can enjoy all the fun, satisfaction, and savings of this whole dimension of photography. Easily.

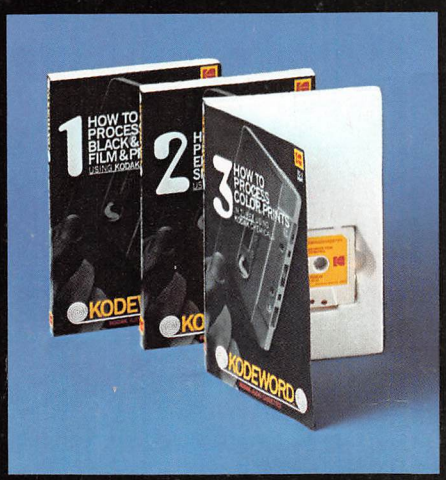
Each tape is like having a personal, professional coach leading you in the darkroom. Teaching you what to do. How. When. For how long.

Just select one or more of the six cassette tape packages on how to process: Black-and-White Film and Prints (TC-1); EKTACHROME Slides (TC-2); Color Prints in Tubes, from slides or negatives (TC-3); Color Negatives (TC-4); Color Prints in KODAK Rapid Color Processors (TC-5); and Color Prints in Trays (TC-6). Read the instructions. Check the few materials needed, listed on the package.

Then play the tape on a cassette player while you process. And discover how easily, quickly, and economically you can become a complete photographer.

The reasonable costs may surprise you. And the savings and pure enjoyment may amaze you. Hear the details.

Kodak



KODEWORD Audio Cassette Program.
For the complete photographer.

About the Cover

Two old cronies conversing on a misty Irish lane were photographed by Ralph Cowan on KODAK High Speed EKTACHROME Film, Daylight (EH135) and printed directly onto KODAK EKTACHROME RC Paper, Type 1993. For this publication, the soft grays and greens of Erin were photomechanically reproduced from the Ektachrome print.

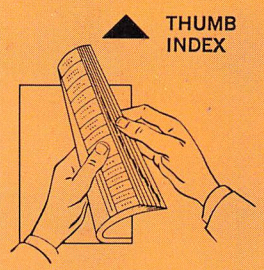
PRINTING COLOR SLIDES and LARGER TRANSPARENCIES

Table of Contents

Punched to fit the **Binder for Kodak Technical Information** (W-4), sold by photo dealers.

Standard Book Number 0-87985-153-8

First Edition, Second Printing, 1976



Introduction

To be able to reproduce on paper the colors and densities of a slide or transparency without the trouble, time, and expense of making an internegative is a wish most photographers have made over the years. Either for the personal pleasure of having a framed print of a favorite scene captured on a 35 mm slide or for a valid to-size color print for layout or presentation purposes from an original sheet-film transparency destined for color separation and photomechanical reproduction, a simple, quick, good-quality color reversal printing method has been needed for some time.

The ability to make color prints directly from color transparencies has been with us for many years. Kodak introduced KODAK Color Print Material, Type R, in the '50s, and photofinishing laboratories have been using its improved descendant product, KODAK EKTACHROME Paper, for years. However, the processing chemicals for EKTACHROME Paper, Process P-111, contained 8 solutions, and with washes, the process consisted of 14 steps and took 51¼ minutes. The process was designed for either continuous-processing machines or batch operations, and it worked best as a well-seasoned, carefully replenished tank system. It was definitely not a process for the single-print, low-quantity darkroom worker.

Recently KODAK EKTACHROME Paper has been replaced by KODAK EKTACHROME RC Paper, Type 1993. Type 1993 Paper can be processed by two new sets of chemicals: KODAK EKTAPRINT R-5 Chemicals, for continuous-processing machines and batch processing; and KODAK EKTAPRINT R-500 Chemicals, for use in KODAK Rapid Color Processors, or equivalent. Now you can make color prints from color transparencies in a darkroom equipped with conventional color printing equipment, and process a print in less than 13 minutes.

The Color Reversal Process: How It Works

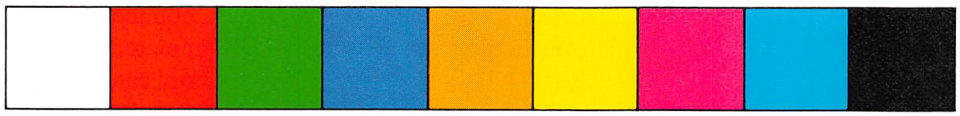
A normal black-and-white photographic film, exposed and developed in the usual manner, yields a negative image of its subject. The silver deposit is heaviest (darkest) in areas corresponding to the brightest areas of the subject and least (lightest) in areas corresponding to the darkest areas of the subject. From such a negative, it is simple to make positive black-and-white prints by repeating the process, using photographic printing paper.

When a positive transparency is the final goal, it is possible to process the original film in such a way that a positive is produced directly. This "reversal" processing is based on the fact that development of a negative image leaves in the emulsion a small amount of silver halide where the negative density is highest, and a large amount of silver halide where the negative density is the lowest. Thus the silver halide *not* used to form the negative has the gradations of a positive.

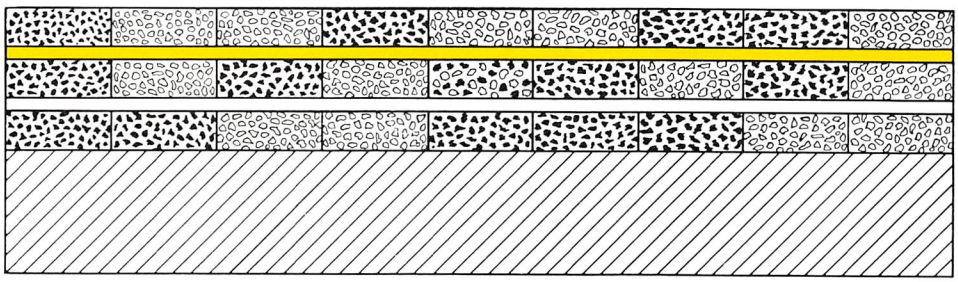
In processing KODAK EKTACHROME Films and KODAK EKTACHROME RC Paper, the reversal technique is employed in order to produce positive color images. First, the exposed color material is developed in a black-and-white developer, which produces a negative silver image in each of the three emulsion layers. Then the emulsion is reexposed in order to fog the remaining silver halide and render it developable (or subjected to chemical reversal in the color developer). This latent positive silver image is then processed by a method called "coupler development" to form three positive dye images: cyan, magenta, and yellow.

The chemical reaction known as coupler development reduces exposed silver halide to form metallic silver. The developer itself is oxidized by the reaction, and it then combines with another chemical substance known as a "coupler." The product of this secondary reaction is a

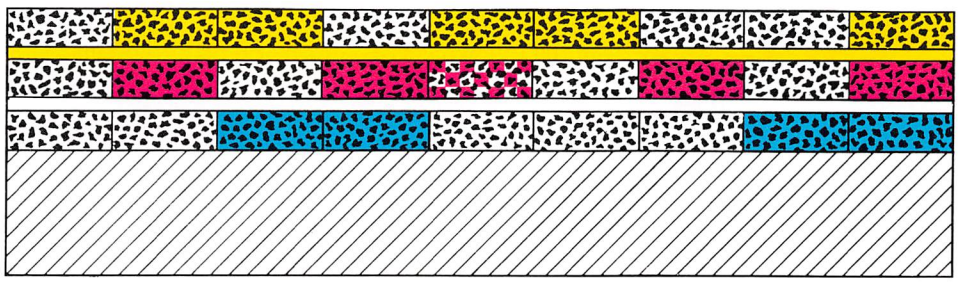
REPRODUCTION OF COLORS BY REVERSAL COLOR MATERIALS



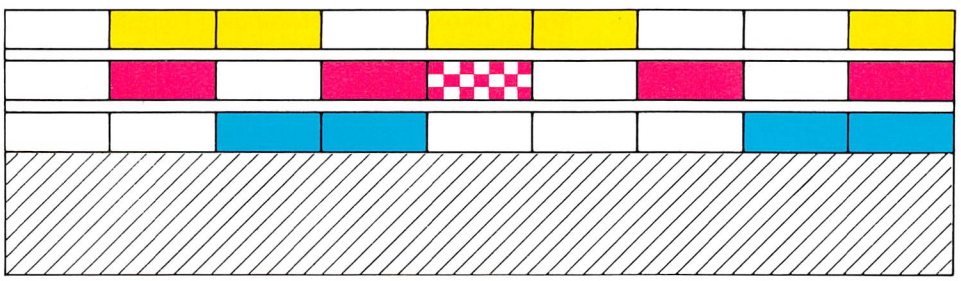
Original subject, represented schematically by color patches.



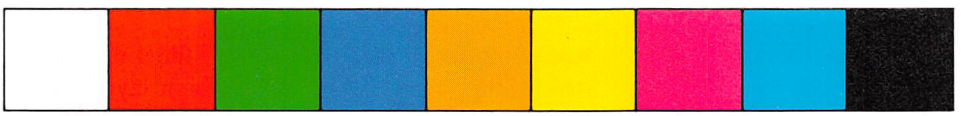
Cross section of color material after silver halide grains exposed to the subject have been developed to produce negative silver images.



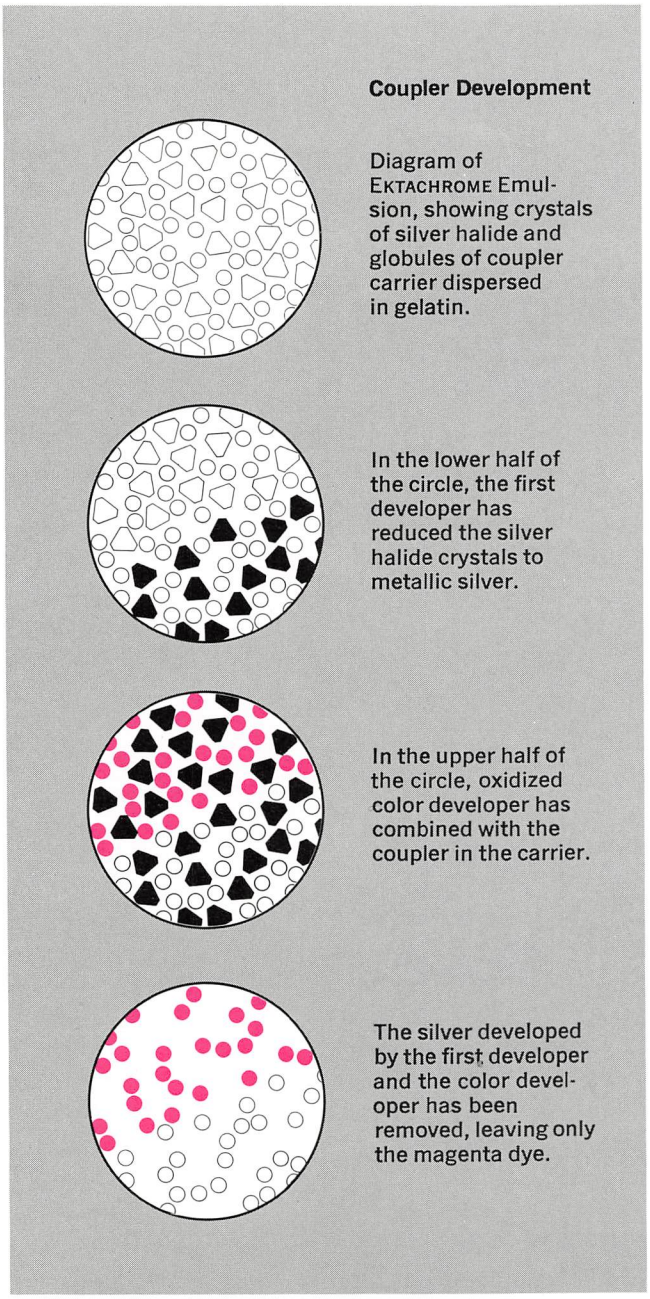
Cross section of color material after the remaining silver halide grains have been exposed to light (or subjected to chemical reversal) and developed to produce positive silver and dye images.



Cross section of color material after both negative and positive silver images have been removed, leaving only the positive dye images.



Dye images as they appear after processing is complete.



colored compound, or dye. The dye-forming reaction produces dye in proportion to the amount of silver developed, and since the dye is insoluble, it remains where it is produced to form a photographic image in color. After the coupler development, the film is treated in a bleach, which without affecting the dyes, converts the metallic silver to salts which are soluble in fixer. Fixing, washing, and drying complete the process. KODAK EKTACHROME RC Paper, Type 1993, is treated in a bleach-fix solution after development, which combines the two steps of the color transparency process. Removing the opaque silver salts renders the dye images in the emulsion layers clear and transparent.

KODAK Color Reversal Films

Kodak reversal-type color films are designated by the use of the suffix "-chrome" in the product name, as in KODACHROME and EKTACHROME (whereas Kodak negative-positive color films are designated by the use of the suffix "-color" in the product name, as in VERICOLOR and KODACOLOR). The transparencies obtained from color reversal films are viewed on an illuminator or by projection. The transparencies can be duplicated by several methods. Color prints of the transparencies can be made by the Kodak Dye Transfer Process and on KODAK EKTACOLOR 37 RC Paper from color internegatives, as well as by direct printing onto KODAK EKTACHROME RC Paper, Type 1993.

KODAK EKTACHROME Films for Process E-6: These new films, which are manufactured with hardened emulsion for high-temperature processing (38°C [100.4°F]), contain chemical couplers which form dye images during processing (see page 2). The films can be processed by a large number of color processing laboratories, or you can process them yourself. Prepared chemicals are supplied as KODAK Chemicals for Process E-6 in several sizes. KODAK EKTACHROME Films for Process E-6 are available in the following sizes for general picture-taking:

EKTACHROME 64 Professional (Daylight)—sheet film sizes, EPR135-36, EPR120, and 35 mm, 46 mm, and 70 mm long rolls.

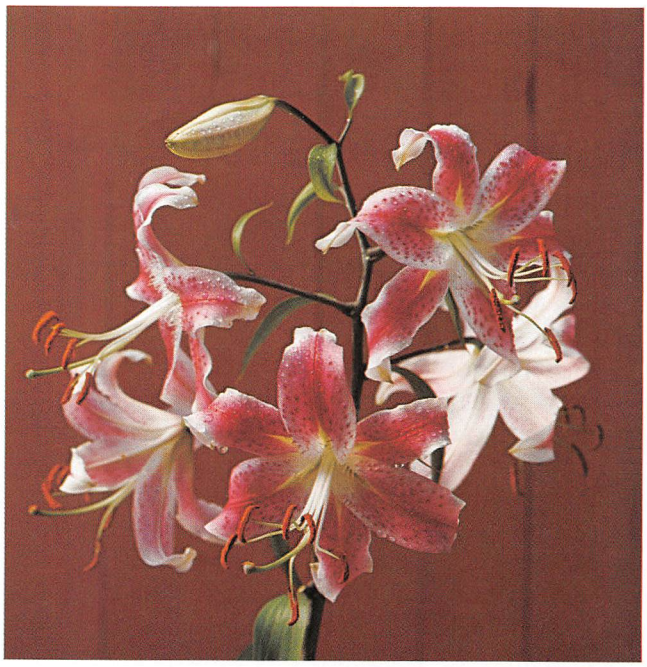
EKTACHROME 200 Professional (Daylight)—EPD135-36, EPD120, and 35 mm and 70 mm long rolls.

EKTACHROME 50 Professional (Tungsten)—sheet film sizes, EPY135-36, EPY120, and 35 mm long rolls.

EKTACHROME 160 Professional (Tungsten)—EPT135-36, EPT120, and 35 mm long rolls.

Kodak-processed and mounted E-6 Ektachrome slides have a plus (+) symbol on the front and back of the mount. Unmounted E-6 Ektachrome filmstrips contain edge printing that reads "Kodak Safety Film," followed by a four-digit code number, and repeated approximately every 2 inches. A solid square follows each frame number. In addition, the 135-size E-6 films have a 0.05-inch-diameter hole after every fourth perforation along one edge.

KODACHROME Films: Kodachrome films do not contain dye-forming particles in the emulsion layers. These are introduced during the processing from three separate color-developer solutions. Processing is, therefore, much more complex and requires elaborate equipment and controls. Processing can be obtained through a dealer, who



will send the film to a Kodak or other processing laboratory equipped to process it. Kodachrome films can also be sent directly to a Kodak processing laboratory if the Kodak mailers are used.

Kodak processing laboratories and others identify KODACHROME 25 and KODACHROME 64 Transparencies by means of a red + sign on either side of the cardboard slide mount.

Unmounted, processed Kodachrome transparencies can be identified as follows:

A small hole (.050) occurs after every fourth perforation on one side. Each frame number is preceded by a line arrow and followed by a solid square for KODACHROME 25 Film or by a solid oblong and square for KODACHROME 64 Film. "Kodak safety film 5073" for KODACHROME 25 Film, and "Kodak safety film 5032" for KODACHROME 64 Film, is reverse-printed at 2-inch intervals. (If this legend is positive-printed, the film is the export type.)

Remember that much of the quality of the final print depends upon the quality of the original transparency. Overexposed slides, with large areas of clear highlights, will reproduce with even larger areas of white paper. Underexposing the print will not correct the white areas but will emphasize them against dark midtones. On the other hand, slightly underexposed transparencies will open up, or lighten, with extra exposure on the print. However, the best Ektachrome prints are made from transparencies that are exactly exposed and processed, with clean whites and neutral shadows. Transparencies of subjects that are low to medium in contrast will reproduce best. High-contrast subjects may suffer loss of detail in both highlight and shadow areas.

Controlling Contrast in Camera

This lovely Jan De Graaf hybrid of Lilium Rubrum was photographed by Bill Reedy in full sunlight and again using a 4 x 5-foot sheet of plastic-laminated fiber glass to diffuse the sunlight and lower the contrast. The color illustrations are from 2¼-inch square Kodak Ektachrome-X transparencies.

KODAK EKTACHROME RC Paper, Type 1993

KODAK EKTACHROME RC Paper, Type 1993, consists of three emulsion layers—sensitive to red, green, and blue light—on a medium-weight, resin-coated base.

The water resistance of the resin-coated base minimizes the absorption of liquids. This characteristic, among other factors, has permitted a reduction in processing and drying times. Prints made on this paper have greater strength and dimensional stability than those made on predecessor products, and have less tendency to curl and crack under conditions of low relative humidity.

The surface texture of KODAK EKTACHROME RC Paper, Type 1993, is inherent in the particular paper. Normal air-drying of F paper results in a glossy surface, and the Y paper yields a silk surface. Ferrotyping or texturing by placing wet prints against smooth or patterned surfaces is *not* recommended. The moisture in the emulsion cannot escape readily through the resin-coated base. Long drying times and sticking may result.

Safelight: Handle the KODAK EKTACHROME RC Paper, Type 1993, in total darkness only. During the processing of KODAK EKTACHROME RC Paper, Type 1993, on a KODAK Rapid Color Processor, Models 11 or 16-K, a safelight fitted with a KODAK Safelight Filter No. 10 (dark amber) and a 7½-watt bulb or a KODAK Safelight Filter OA (greenish yellow) and a 15-watt bulb can be used during the first wash and color developer steps. Handling under a safelight should be kept to a minimum in order to avoid blanket shadow patterns on some of the lower density areas of the print. The safelight should be located above the processor at least 4 feet away.

Storage: Keep the paper in the original sealed package in a refrigerator or freezer at 10°C (50°F), or lower. To avoid moisture condensation on cold unexposed paper, allow the paper to warm up to room temperature before opening the sealed bag. *For best results, remove unexposed paper from cold storage the day before printing;* otherwise, follow the typical warm-up times listed.

These times are based on a single package, positioned to allow sufficient airspace to permit free air circulation.

Paper Size	−18 to 21°C (0 to 70°F)	2 to 21°C (35 to 70°F)	10 to 21°C (50 to 70°F)
3½″ x 700′	8 hours	6 hours	4 hours
8″ x 500′	10 hours	7 hours	4 hours
8″ x 10″ (100 sheets)	4 hours	3 hours	2 hours
16″ x 20″ (50 sheets)	3 hours	2 hours	2 hours

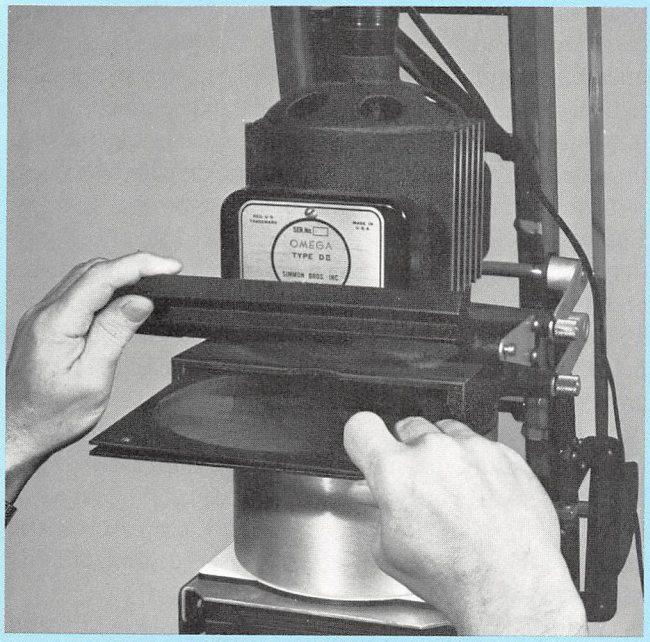
As supplied, EKTACHROME RC Paper is protected by a laminated foil bag that is moistureproof. The bag has a sealed double fold at one end. This wrap is essential to the protection of the paper and should be handled carefully. Even a small tear in its surface will destroy its usefulness. After proper tempering and in total darkness, open the moisture barrier by breaking the paper-tape seals, and carefully unfold the long end of the bag. After removing the paper to be exposed, restore the moisture barrier around the unused paper by pressing out the excess air, remaking the double fold at the end of the bag, and securing it with masking tape. Return the package to the refrigerator immediately. Do not freeze the paper.

The sheet-paper supply should be placed flat in a dark drawer. EKTACHROME RC Paper is packaged with the emulsion sides all facing one way. Handle the paper carefully to avoid making kink marks and fingerprint smudges.

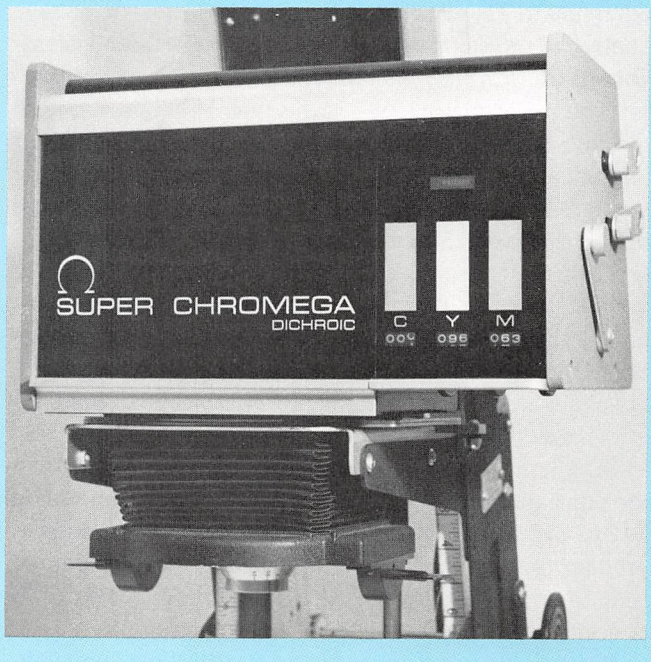
Notice: KODAK EKTACHROME RC Paper, Type 1993, contains dyes that are as stable as possible, consistent with other requirements. Like other dyes, they may change in time. This material, therefore, will not be warranted against any change in color.

Latent-Image Keeping: For the most consistent results, keep the time interval between exposure and processing of EKTACHROME RC Paper as nearly uniform as possible. A print processed several hours after exposure may differ in both color balance and density from an identically exposed print processed immediately after exposure. If possible, expose and process the paper on the same day. However, if it is necessary to hold exposed prints between 8 and 24 hours before processing, store them at 10°C (50°F) or lower. If the holdover time will exceed 24 hours, store the prints at −18°C (0°F). Maximum holdover time for exposed but unprocessed prints at −18°C (0°F) is 3 days. Pack the stored prints in moistureproof bags and always allow them to warm up to room temperature before processing. This cold-storage procedure is intended to handle unusual situations, and is not recommended as a general practice.

Availability: KODAK EKTACHROME RC Paper, Type 1993, is available in sheet sizes from 8 x 10 inches to 30 x 40 inches in F (glossy) surface, and rolls 3½, 5, 8, 11, and 16 inches wide by up to 700 feet in length in F and Y (silk) surfaces on a medium-weight, resin-coated base.



An enlarger modified for color printing (**Omega** Type DII, manufactured by Simmon Brothers Inc., Long Island City, New York, a division of Berkey Photo Inc.). Color printing filters are assembled in a frame and inserted in the drawer below the lamphouse.



An enlarger designed for color printing (**Super Chromega** Dichroic, manufactured by Simmon Brothers Inc., Long Island City, New York, a division of Berkey Photo Inc.). Internally contained dichroic filters are adjusted by controls under the right side of the lamphouse and the amount of filtration is indicated in .01 increments on color-coded digital readouts.

Exposing Equipment

KODAK EKTACHROME RC Paper, Type 1993, can be exposed on printers and enlargers designed for color-negative printing. The light source should have a color quality equivalent to that of a Photo Enlarger Lamp No. 302 (3150 K), No. 212 (2950 K), or tungsten-halogen (3200 K). Do *not* use fluorescent lamps. The enlarger should be equipped to hold filters, such as KODAK Color Printing Filters (Acetate), KODAK Color Compensating Filters (Gelatin),* or dichroic filters. An ultraviolet absorber (such as the KODAK WRATTEN Filter No. 2E),† a KODAK Infrared Cutoff Filter No. 301A, and a heat-absorbing glass should also be included (see page 10).

An enlarger lens should be of sufficient focal length to cover the transparency sharply to the edges. It should be of good quality, and preferably color-corrected and coated to reduce flare. Also it must be clean and free from dust and fingerprints, because a good enlargement cannot be made with a dirty lens.

*Note: If cyan filtration is necessary, do not use filters identified by the suffix "-2," as in "CC10C-2" or "CP10C-2" (see page 10).

†Although the KODAK WRATTEN Filter No. 2E is recommended for printing EKTACHROME RC Paper, some printers and enlargers are equipped with a KODAK WRATTEN Filter No. 2B and may yield acceptable results for many applications.

Voltage Control

Stable voltage is necessary for consistent results, and fluctuations in line voltage are more common than is generally realized. Some are characteristic of the time of day; others depend on the use of other electrical equipment in the immediate vicinity.

Changes in the voltage applied to a tungsten lamp affect both the light output and the color quality of the light. In the normal operating range (100 to 125 volts), a 5-volt variation changes the output by about 15 percent and the color quality by about the magnitude of a CC10 filter. The effect is greatest with the blue component of tungsten light, and least with the red. Changes in the color quality and output of the illumination cause changes in the color balance and density of prints.

The effect of either slow or sudden changes in the line voltage can be eliminated by installation of appropriate equipment. There are two applicable forms of voltage controller on the market. The first type is the constant-voltage transformer, sometimes called "voltage stabilizer" or "voltage regulator." When this type of unit is placed in the line between the source of power and the enlarger lamp, it automatically smooths out any fluctuations in the voltage. Even though the input voltage varies anywhere between 95 and 130 volts, the output from the transformer will remain essentially constant at the rated value.

The other type of voltage controller consists of a manually adjustable variable transformer, or "autotransformer." This type does not automatically adjust the output voltage when the input changes, but the control knob allows manual adjustment back to the desired voltage.

In general, this type of controller is less expensive than the constant-voltage type and allows voltages other than 110 or 115 to be used if desired. The major disadvantages are that it is not self-regulating, therefore requiring more time to be adjusted, and that it cannot be made to compensate for rapid fluctuation.

If a variable transformer is used to adjust the lamp voltage, a voltmeter must be provided (if one is not built into the controller) to allow checking and adjustment of the voltage before each exposure.

The controller may have more capacity than is needed. However, the lamp cannot have a higher wattage rating than the volt-ampere rating of the controller, or instability and failure of the unit will result.

If a voltage regulator or variable transformer is not used, try to expose your color prints during times when the line voltage is not likely to fluctuate. Avoid mealtimes when electric ranges in the building are being turned on and off. Avoid times of sunrise and sunset, and times of factory shift changes when heavy electrical equipment is turned on or off.

Most color enlargers using tungsten-halogen lamps, which operate at reduced voltages, are equipped with step-down transformers which automatically act as voltage regulators. No further voltage control is necessary.

Darkroom Ventilation

An important consideration in the production of color prints from transparencies is proper atmospheric conditioning of the darkroom. Laboratory operations in color photography are accompanied by chemical fumes, high humidity from elevated temperatures of processing solutions, heat from electric motors and high-intensity light sources, and dust from practically everywhere.

Much more than the comfort and efficiency of personnel is involved in proper conditioning of the darkroom atmosphere. The quality of every print can be affected adversely by the contaminants mentioned above. The remedy for excess heat and humidity is properly installed air conditioning which will maintain temperatures between 21 and 24°C (70 and 75°F) and relative humidity between 45 and 50 percent. Air-conditioning units which maintain a positive pressure in the darkroom in addition to filtering the incoming air will assist in keeping dust to a minimum. Proper housekeeping also goes a long way in preventing dust problems, which are especially bothersome in printing color transparencies, since dust spots on EKTACHROME Paper prints are black, and therefore very difficult to retouch. Periodic vacuuming of equipment and furnishings and weekly wet-mopping of the floors are essential. Clean up chemical spills and drips immediately, before they can evaporate. Change dust filters in furnaces, air conditioners, and air cleaners regularly.

Forbid smoking in the darkrooms. Not only does the ash cause dust of the finest sort, but the smoke itself coats enlarger lenses, transparencies, and printing filters, causing color shifts and focusing problems. During exposures, smoke in the air acts as a subtle diffuser, degrading tonal separation and color balance in the prints.

Clean darkroom practice and proper ventilation and filtration pay for themselves in greatly reduced retouching costs and lower make-over rates. However, with the popularity of small-format color transparencies and demand for large-diameter enlargements from them, dust remains a formidable problem.

Detailed information on darkroom ventilation and air conditioning, as well as proper water, plumbing, and electrical supplies, is given in Kodak Publication No. K-13, *Photolab Design*.

Filters for Printing

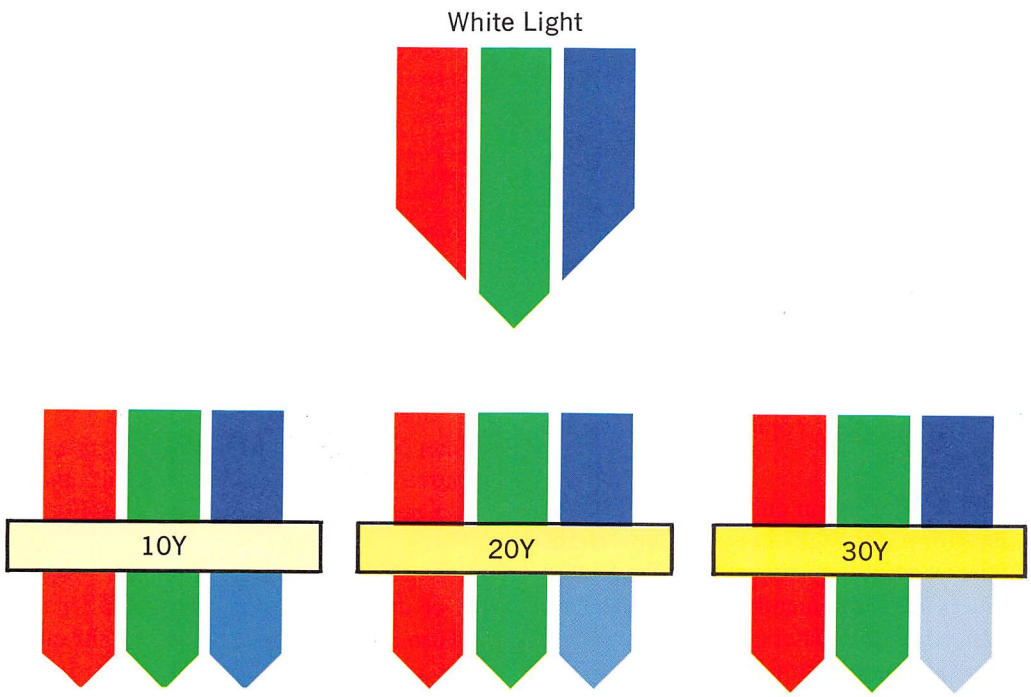
In order to make color prints from transparencies on KODAK EKTACHROME RC Paper, Type 1993, it is necessary to have a method of controlling the color of the printing light source so that it will produce a balanced print on a particular emulsion of paper from a particular type of color transparency. Two methods of color control are available: The first method is the tricolor method, in which three additive color exposures, through red, green, and blue separation filters, such as KODAK WRATTEN Filters No. 29, 61, and 47B, print the information contained in the cyan-, magenta-, and yellow-colored dye layers of the transparency onto the print material. The ratio of the exposure times controls color balance in the print. The second method is the white-light method, in which a single exposure is made by tungsten light. Subtractive filters—cyan, magenta, or yellow (or a combination of two colors)—modulate the quality of the printing light. Because it is the most commonly used, this book will concentrate on the white-light method.

Filter Fundamentals

White light is made up of red, green, and blue components. When these components are absorbed differentially by filters, there is a change in both the color and intensity of the light.

A yellow filter transmits almost all of the red and green components of white light, but absorbs or subtracts part of the blue component. The proportion of blue light that is subtracted depends on the density of the yellow filter.

The same principle applies to filters of the other two subtractive primary colors. A magenta filter transmits red and blue light, but subtracts green light. A cyan filter transmits green and blue light, but subtracts red light.



10C + 10M + 10Y = NEUTRAL

A combination of many filters, expressed in terms of the subtractive primaries, may reveal the absorption of all three components. This absorption is neutral density. Since it reduces the intensity of the light without giving any color correction, it should be removed.

10R = 10M + 10Y

10G = 10C + 10Y

10B = 10C + 10M

To figure the neutral density of a filter system, reduce all filter colors to their equivalents in cyan, magenta, and yellow.

Note that the color density remains the same in the division: 10R becomes 10M and 10Y, **not** 05M and 05Y. The converse is also true: 20C plus 20Y equals 20G. Similarly, 10C plus 10M plus 10Y equals 0.10 neutral density.

10M + 20M = 30M

However, when filters of the same color are combined, the densities add normally. For example, 10M plus 20M equals 30M.

White-Light Printing Filters

Either KODAK Color Printing (CP) or KODAK Color Compensating (CC) Filters, or their equivalent, can be used.

In the typical filter designation CP20Y, "CP" stands for "Color Printing," "20" for a density of "0.20," and "Y" for "Yellow," the color of this filter. The density designation applies only for light of the color that the filter is designed to absorb (its complement); in this case, blue light. In other words, if a CP20Y filter is placed in a light beam, it reduces the blue-light exposure by 0.20 log exposure units, or acts like 0.20 neutral density for the blue-light exposure. It does not affect appreciably the passage of red and green light.

Color Printing Filters: For use in enlargers that provide a convenient means for placing the filter pack between the light source and the transparency, the acetate-film KODAK Color Printing Filters are recommended. These filters are less expensive than gelatin-film filters, but they cannot be used in the path of the image-forming light because they would affect definition.

The CP filters are not supplied in green or blue because the number of filters between the light source and the transparency is not important. Hence these colors can, if they are needed, be obtained by using the proper combinations of cyan, magenta, and yellow filters.

CP filters available include:

Red	Cyan*	Magenta	Yellow
	CP025C		
CP05R	CP05C	CP05M	CP05Y
CP10R	CP10C	CP10M	CP10Y
CP20R	CP20C	CP20M	CP20Y
CP40R	CP40C	CP40M	CP40Y
CP80R			CP80Y

Color Compensating Filters: For use at the lens, gelatin-film filters are recommended. These are somewhat more expensive than acetate filters, but they can be used in much smaller sizes. In order to avoid flare and loss in definition, it is important to use the smallest possible number of filters at the lens. KODAK Color Compensating Filters are supplied in red, green, and blue, in addition to cyan, magenta, and yellow, and in a more complete range of densities than the Color Printing Filters. With not more than three CC filters, it is therefore possible to obtain practically any color and density combination needed.

The complete listing of CC filters is as follows:

Red	Green	Blue	Cyan*	Magenta	Yellow
CC025R			CC025C	CC025M	CC025Y
CC05R	CC05G	CC05B	CC05C	CC05M	CC05Y
CC10R	CC10G	CC10B	CC10C	CC10M	CC10Y
CC20R	CC20G	CC20B	CC20C	CC20M	CC20Y
CC30R	CC30G	CC30B	CC30C	CC30M	CC30Y
CC40R	CC40G	CC40B	CC40C	CC40M	CC40Y
CC50R	CC50G	CC50B	CC50C	CC50M	CC50Y

*Another series of cyan filters is available in the listed densities. These filters, having the suffix "-2," can be used with KODAK EKTACOLOR 37 RC Paper, KODAK EKTACOLOR Print Film, and KODAK EKTACOLOR Slide Film. The cyan-2 filters have more absorption than cyan filters in the far-red and infrared portion of the spectrum, where these print materials have significant sensitivity. However, their peak absorptions do not precisely match the spectral sensitivity of EKTACHROME RC Paper to red light, therefore, cyan-2 filters are not recommended for printing color transparencies.

Cutoff Filters: KODAK EKTACHROME RC Paper, Type 1993, is sensitive to both ultraviolet and infrared radiation. Therefore, when the paper is being printed by the white-light method, it should be protected by the use of an ultraviolet absorber, such as the KODAK WRATTEN Filter No. 2E, and heat-absorbing glass between the light source and the transparency at all times; in addition you may need a KODAK Infrared Cutoff Filter, No. 301A.

KODAK Infrared Cutoff Filter, No. 301A: This is a multilayer dichroic interference-type filter coated on glass. It transmits a high percentage of light out to 680 nanometers and reflects unwanted infrared radiation. Called a "hot mirror" because of its near-infrared (heat) reflection capabilities, the No. 301A Filter has very low absorbance and can be used in high-intensity light beams. It is available in 2-, 3-, and 4½-inch squares.

In automatic, high-volume printers where one basic filter pack is used, the KODAK Infrared Cutoff Filter, No. 301A, is recommended in order to minimize printing differences when mixtures of KODACHROME and EKTACHROME Transparencies are printed onto KODAK EKTACHROME RC Paper, Type 1993. In a lower-volume situation, such as where an enlarger is used and there is more than one basic filter pack, the No. 301A Filter is not necessary to obtain optimum results in printing KODACHROME 25 Film, KODACHROME 64 Film, and EKTACHROME Films (Process E-3 and Process E-4). However, the No. 301A Filter *is* necessary for optimum results in printing KODACHROME II and KODACHROME-X Films. In some applications, acceptable results can be obtained for KODACHROME II and KODACHROME-X Films without the No. 301A Filter but with some loss in red contrast, resulting in warm shadows.

Correct positioning of the No. 301A Filter is critical. Place the filter in a perpendicular position close to the light source in a specular, parallel part of the light beam. Tipping the filter or passing light through it at an angle changes the spectral quality of the filter.

Making the First Print

The basic goal in making a color print from a transparency is to make as faithful a reproduction as possible. Once a method of doing this is established, arbitrary changes can be introduced in order to improve upon the original or to make color derivations and interpretations of the original.

In order to produce high-quality Ektachrome prints in any volume, a number of variables in equipment and process must be stabilized. Fortunately, since you have an original color transparency for comparison, there is little difference of personal opinion as to what the final print should look like. Variables, then, consist of equipment operation, differences in transparency types, differences in paper emulsion, and fluctuations in process control. Another variable that influences color print quality is the nature of the light under which the print and the transparency are viewed. See below.

The Standard Transparency

For making the first print, and as a basis for producing prints from other transparencies of unknown quality, it is advisable to select a test transparency that has been carefully exposed with a light source of correct color quality and the proper intensity. Use the type of film that you will be exposing regularly, or better still, make several standard transparencies on the various color materials you will be using. Retain these standard transparencies carefully and use them to establish standard filter packs for batches of EKTACHROME Paper of unknown emulsion characteristics.

Trial Exposure

Make sure that the transparency is free from dust and place it in the enlarger so that its emulsion side is toward the lens. (In this position, the projected image will appear in the proper orientation on the easel.) Elimination of stray light around the edges of the transparency is absolutely essential. Masks of black paper and/or black masking tape will prevent stray light from fogging the paper.

Since enlarging equipment varies considerably, it is difficult to specify exact exposure times and filtration for a properly exposed print on a particular emulsion of EKTACHROME Paper. Therefore, the following procedure is recommended for determining your *first* printing filter pack and exposure time for a standard transparency:

1. Set up the enlarger with an ultraviolet absorber, such as the KODAK WRATTEN Filter No. 2E (or No. 2B), and heat-absorbing glass between the light source and the transparency.

2. Suggested **starting** filter packs for enlargers with tungsten-halogen illumination are as follows:

Ektachrome transparencies (Process E-3, E-4, and E-6)—30C + 20Y. Kodachrome 25 and 64 transparencies—50C + 20Y.

3. With the enlarger positioned to make an 8 x 10-inch enlargement from a 35 mm transparency, make a series of exposures at 10, 20, and 40 seconds at *f*/5.6.

4. Process and dry the test print (Ektachrome prints have an opalescent bluish cast when wet which affects apparent color balance), and then evaluate the density and color balance as described on page 13.

5. Make the estimated filter pack additions and make another test print at the selected exposure time and *f*-stop. Once again, process, dry, and evaluate the test print.

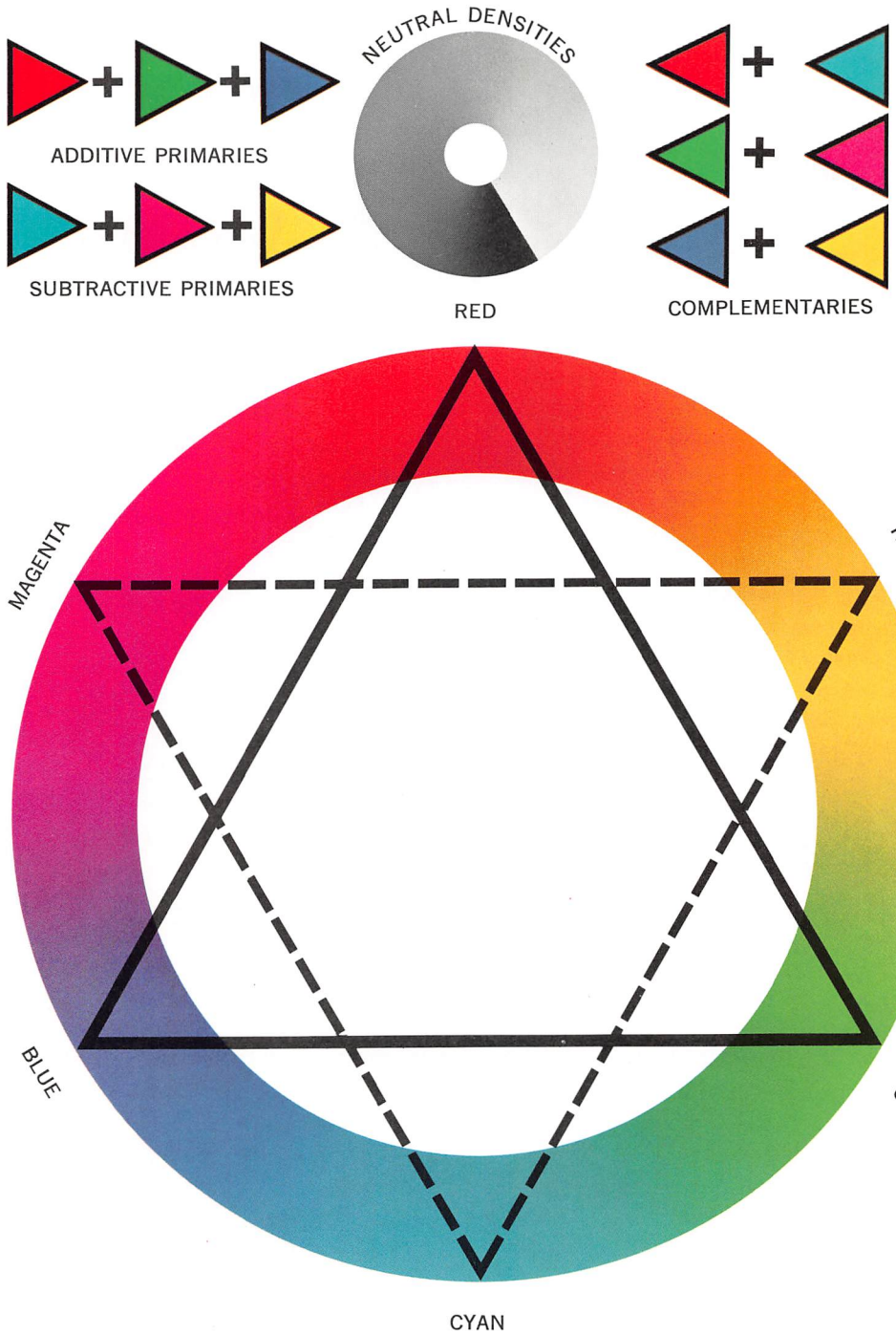
6. When you are satisfied that the density and color balance are correct, record the filter pack and exposure information as your standard printing conditions *for the type of transparency used as the standard.* All other transparencies of that type should produce equally good prints when that standard printing condition is used (at the same diameters of enlargement).

Use the standard printing condition that you have determined for one type of transparency as a starting filter pack for determining the standard printing condition for other types of transparencies, rather than returning to the suggested starting filter pack designation (No. 3 above).

In making test exposures, the use of the KODAK Projection Print Scale, as used in black-and-white enlarging, is not recommended. Because of variations in sensitivity of the emulsion layers with illumination level and exposure time, the use of a device of this type is not likely to lead to reliable exposure predictions.

Judging Test Prints

The color quality of the viewing light source strongly influences the apparent color balance of the print. Ideally, the evaluation area should be illuminated by light of the same color quality and intensity as that under which the final print is to be viewed. From a practical standpoint, some average condition must be selected.



Photographic Color-Light Relationships

THIS COLOR CIRCLE represents the visible light spectrum. The six individual colors—Red, Green, Blue, Cyan, Magenta, and Yellow—are single points on this continuously changing band of light. However, they have special photographic relationships to each other. The Additive Primary Colors (Red, Green, and Blue) added together in approximately equal amounts, as with **three projectors** aimed at a screen, will produce white light. The Subtractive Primary Colors (Cyan, Magenta, and Yellow) added together in approximately equal amounts, as with three filters on a **single light source,** will absorb all color and produce Black or shades of Gray; that is, Neutral Density.

Each Primary Color on the light-spectrum circle is composed of equal amounts of its adjacent colors, and is complementary to the color directly across the center of the circle. Complementary Colors, added together, also form Neutral Densities.

The interaction of the Additive Primary Colors, in photographic light sources, and the Subtractive Primary Colors, in the filters, form the controls so necessary in color photography.

Several factors are important in specifying light sources for viewing color prints. These are intensity, color temperature, and Color Rendering Index (CRI). The intensity of the light source influences the amount of detail that can be seen in the print. For good viewing, a light source should provide an illuminance of 100 ± 50 footcandles. An illuminance of 50 footcandles should be considered a minimum level. The color temperature of the light source should be 4000 K ± 1000 K. A color temperature of 3800 to 4000 K serves well as an average of various viewing conditions.

The most important characteristic of the light source is its Color Rendering Index (CRI). The CRI is a scale from 0 to 100 used to describe the visual effect of a light source on eight standard pastel colors. These eight colors are viewed under light from the source to be rated, and under light from a blackbody source of equivalent color temperature. The average difference in the appearance of the colors is used to determine the CRI. The closer the comparison between the sources, the higher the CRI of the source to be rated. Since the rated light is compared only to a blackbody which best matches it, the CRI readings of two sources of different color temperature cannot be compared. For good rendering in the prints being viewed, the CRI of the light source should be 85 to 100, with a CRI of 90 or higher being desirable.

The quality of light source having a CRI of at least 85 and an equivalent color temperature near 4000 K is approximated by several types of fluorescent lamps (in fixtures), such as General Electric Living White, General Electric Deluxe Cool White, Sylvania Deluxe Cool White, Westinghouse Deluxe Cool White, and Westinghouse Living White. Satisfactory results can also be obtained by using a mixture of incandescent and fluorescent lights. For each pair of 40-watt deluxe cool white fluorescent tubes, a 75-watt frosted tungsten bulb can be used.

When comparing an EKTACHROME Paper print to its original color transparency for color balance, be sure that the transmission and the reflection light sources are equal in both color temperature and CRI.

It is difficult to compare a print to a transparency for density correction. The density range of a reflection print is inherently much lower than that of a transparency viewed by a transmitted light. Therefore, prints on EKTACHROME RC Paper should be evaluated for density by examination of highlight and shadow detail, not by comparison with the original transparency. Remember, in making exposure corrections, that EKTACHROME RC Paper is a reversal paper. Therefore, add exposure time or intensity to make a lighter print; subtract exposure time or intensity to make a darker print.

The simplest method of evaluating the color balance of a print is to compare it to the original transparency. Examine the midtones to see if they vary in color from the midtones of the transparency. If it is difficult to decide what color is in excess, examine the print through filters, such as those contained in the *KODAK Color Print Viewing Filter Kit,* Publication No. R-25, until the overall appearance of the print most nearly matches the transparency. The filter that makes the print appear most pleasing represents the correct color to add to the printing filter pack.

The following table will be helpful in determining the filter pack adjustment.

If the overall color balance is:	Subtract these filters:	or	Add these filters:
Yellow	Yellow		Magenta + Cyan
Magenta	Magenta		Yellow + Cyan
Cyan	Cyan		Yellow + Magenta
Blue	Magenta + Cyan		Yellow
Green	Yellow + Cyan		Magenta
Red	Yellow + Magenta		Cyan

When making filter corrections to the printing filter pack, remove filters from the pack whenever possible. For example, if a test print is reddish in balance, remove yellow and magenta filters rather than adding cyan filters.

(If you are accustomed to making color prints on KODAK EKTACOLOR 37 RC Paper from color negatives, you may find that it takes a greater change in filter pack to accomplish the desired result with KODAK EKTACHROME RC Paper, Type 1993.)

The filter pack should not contain more than two colors of the subtractive filters (cyan, magenta, and yellow). The effect of all three is to form neutral density, which lengthens the exposure time without accomplishing any color correction. To eliminate neutral density, remove the filters of one color entirely, and remove the same density value of each of the other two colors.

Exposure Adjustment for Filters: Whenever the filter pack is changed, allowance should be made for the change in exposure introduced by (1) the change in filtering action and (2) the change, if any, in the number of filter surfaces. Otherwise, the density of the corrected print will differ from that of the test print.

If the pack is changed by only one filter, use of the appropriate filter factor in the following table is convenient. Otherwise, the use of the computer numbers with the Color-Printing Computer in the *KODAK Color DATAGUIDE,* Publication No. R-19, will probably be preferred.

Computer Numbers and Factors for KODAK CC and CP Filters

Filter	Computer No.	Factor	Filter	Computer No.	Factor
05Y	.04	1.1	05R	.07	1.2
10Y	.04	1.1	10R	.10	1.3
20Y	.04	1.1	20R	.17	1.5
30Y	.05	1.1	30R	.23	1.7
40Y	.05	1.1	40R	.29	1.9
50Y	.05	1.1	50R	.34	2.2
05M	.07	1.2	05G	.06	1.1
10M	.10	1.3	10G	.08	1.2
20M	.16	1.5	20G	.12	1.3
30M	.22	1.7	30G	.15	1.4
40M	.27	1.9	40G	.18	1.5
50M	.32	2.1	50G	.22	1.7
05C	.06	1.1	05B	.04	1.1
10C	.08	1.2	10B	.12	1.3
20C	.12	1.3	20B	.21	1.6
30C	.15	1.4	30B	.29	2.0
40C	.18	1.5	40B	.38	2.4
50C	.21	1.6	50B	.47	2.9

To use computer numbers: Add the computer-number values for all the filters in the old pack. On the "Density" scale of the Color-Printing Computer, set the sum of the computer numbers so that it is opposite the exposure time used. Read the new exposure time opposite the sum of the computer numbers for the new pack.

To use factors: First divide the old exposure time by the factor* for any filter removed from the pack. Then multiply the resulting time by the factor* for any filter added.

*For two or more filters, multiply the individual factors together and use the product.

Dichroic Filters: Filter factors are not required for computing exposures if the enlarger is equipped with cyan, magenta, and yellow dichroic filters. Dichroic glass filters are sharp-cutting interference filters that completely block the wavelengths of light to which they are complementary and have practically no effect on other wavelengths. The enlarger light source is modified by inserting a wedge of the filter part way into the beam. Therefore, no increase in exposure is necessary to compensate for changes in the number of filter surfaces. With gross filter changes, exposure compensation for relative differences in print dye densities will be necessary, but the amount of change cannot be predicted on the basis of filter factors. Since individual dichroic filter sets have their own characteristics, use an on-easel color photometer, or draw on experience to estimate exposure corrections.

Adjustment for Change of Emulsion Number: In multilayer color materials, there are unavoidable differences in color balance and speed from one emulsion number to another. The extent of these variations is noted on the EKTACHROME RC Paper package label in the form of "filter correction" values. After the material leaves the factory, further color-balance and speed variations are minimized by proper storage and processing.

Note that the filter correction may contain both + and — values. This information is helpful in changing from one emulsion number to another. Follow the procedure below to determine the new filter pack and exposure time when changing to a new emulsion.

Filter calculations are made easier by converting all filters to their equivalents in subtractive colors, if they are not already of the subtractive colors (for example, 20R = 20M + 20Y). Also, filters of like colors should be added together in the calculations (for example, 10M + 20M = 30M).

1. Determine the basic filter pack by *subtracting* the filter correction printed on the label for the old emulsion from the filter pack used for that emulsion.

EXAMPLE:

Step 1: Suppose the filter pack required for the old emulsion was 10C+05Y, and the Filter Correction printed on the package label of that emulsion was +10C —25M —05Y. Set up these values as follows:

Filter pack used for the old emulsion	+10C	0M	+05Y
(Subtract) old emulsion Filter Correction Value	+10C	—25M	—05Y
To simplify the subtraction of minus values, follow this rule: "Change **all** the signs of the values to be subtracted and proceed as in addition."	+10C	0M	+05Y
	—10C	+25M	+05Y
	0C	+25M	+10Y
	(basic filter pack)		

2. Determine the filter pack required for the new emulsion by *adding* the filter correction value printed on the label for the new emulsion to the basic filter pack.

EXAMPLE:

Step 2: Suppose the Filter Correction Value of the new emulsion is —05C +25M —20Y.

Basic filter pack	0C	+25M	+10Y
(Add) Filter Correction Value for new emulsion	—05C	+25M	—20Y
Preliminary filter pack	—05C	+50M	—10Y

3A. If negative filter values are present in the pack, add (by calculation) C, M, and Y "neutral density" equal to the largest negative filter. In this way, one of the three filters will become zero. Look up the neutral density factor on page 15, Section A.

EXAMPLE:

Step 3A: Since negative filter values are present in the pack, add 10 neutral density (+10C +10M and +10Y) to these values.

Preliminary filter pack	−05C	+50M	−10Y
(Add) neutral density	+10C	+10M	+10Y
Final filter pack for new emulsion	+05C	+60M	0Y

Look up a 10 neutral density in Section A of the table below. The neutral density factor comes out to 1.3 in this case.

or

3B. If all the filter values are positive, subtract C, M, and Y "neutral density" equal to the smallest positive filter value. At least one of the three will now be zero. Look up the neutral density factor in Section B, below.

or

3C. If the filter values are positive and at least one is zero, go to Step 4. Your neutral density factor is 1.0.

4. Calculate the new exposure time by the following formula:

$$\begin{pmatrix}\text{Exposure Time for the New Emulsion}\end{pmatrix} = \begin{pmatrix}\text{Exposure Time for the Old Emulsion}\end{pmatrix} \times \text{(Neutral Density Factor)}$$

EXAMPLE:

Step 4: Suppose the exposure time used for the old emulsion was 8.5 seconds and the neutral density factor was 1.3. Calculate the new exposure time by the formula:

$$\begin{pmatrix}\text{Exposure Time for the New Emulsion}\end{pmatrix} = \begin{pmatrix}\text{Exposure Time for the Old Emulsion}\end{pmatrix} \times \text{(Neutral Density Factor)}$$

New Exposure Time $= 8.5 \times 1.3$
$= 11$ seconds

This is the exposure time that should be tried for the new emulsion.

Neutral Density Factors

CC Neutral Density Added in Step 3A or Subtracted in Step 3B	Section A	Section B
5	1.1	.89
10	1.3	.77
15	1.4	.70
20	1.6	.62
25	1.8	.54
30	2.1	.48
35	2.3	.43
40	2.6	.38
45	3.0	.33
50	3.4	.29
55	4.5	.22
60	5.6	.18
65	7.0	.14
70	8.3	.12
75	9.5	.10
80	10.7	.093
85	11.7	.085

5. Use the new filter pack and the printing times calculated as a starting point for a series of test prints using a standard transparency.

White Borders

White borders can be obtained by exposing the border areas of a print while the picture area is protected by an opaque mask. When the enlarger is adjusted to make a normal print, an exposure from 1½ to 2 times the print exposure time will be required, with no transparency in the beam. Do not remove the filters when flashing the border. Some overlapping of the print exposure and the border exposure is necessary in order to eliminate dark edges.

With automatic and semiautomatic equipment, follow the instructions supplied with the equipment.

Processing

This section supplements the instructions packaged with the Kodak color print processing chemicals. The instructions should be consulted for details of the processing steps.

KODAK EKTACHROME RC Paper, Type 1993, can be processed quickly and easily on all of the KODAK Rapid Color Processors, the Model 11, Model 16-K, the Model 30A (or Model 30 equipped with a processing tube having a spiral liner), and on small processing tubes, using KODAK EKTAPRINT R-500 Chemicals (formerly designated KODAK EKTAPRINT RD Chemicals), or equivalent.

KODAK EKTAPRINT R-500 Chemicals are packaged in concentrated liquid form to make 1 gallon and 1 quart of solution per unit. A set of chemicals consists of:

KODAK EKTAPRINT R-500 First Developer
KODAK EKTAPRINT R-500 Stop Bath
KODAK EKTAPRINT R-500 Color Developer
KODAK EKTAPRINT R-500 Bleach-Fix
KODAK EKTAPRINT R-500 Stabilizer
*KODAK Potassium Iodide, Crystals, 25 grams
(Model 30A and small tube-type processors only)

*To prepare a stock solution, start with 946 ml (32 fluidounces) of water and add approximately 8 grams (1 teaspoon) of potassium iodide. Mix the solution until all of the crystals are completely dissolved.

Mixing directions are included with each package and must be followed carefully.

Add 30 ml (1 fluidounce) of the potassium iodide stock solution to the wash water preceding the bleach-fix to prevent excessive stain (Model 30A only). Add 30 ml (1 fluidounce of the potassium iodide stock solution to each 964 ml (32 fluidounces) of wash water preceding the bleach-fix for small tube-type processors.

KODAK EKTACHROME RC Paper, Type 1993, can also be processed in a continuous-processing machine, such as a KODAK Continuous Color Print Processor, Models 4R, 4R-3, 4RT, and 451R. Rolls of paper can also be processed on reels, such as KODAK Processing Reels. Sheets of paper can be processed in suitable hangers, in a basket such as the KODAK Processing Basket, or in trays using KODAK EKTAPRINT R-5 Chemicals.

The following KODAK EKTAPRINT R-5 Chemicals are supplied in packaged form. Carefully follow the mixing directions included with the chemicals.

Chemical	Sizes Available
KODAK EKTAPRINT R-5 First Developer Starter	1 pint
KODAK EKTAPRINT R-5 First Developer Replenisher	5 and 25 gallons
KODAK EKTAPRINT R-5 Stop Bath and Replenisher	5 and 25 gallons
KODAK EKTAPRINT R-5 Color Developer Starter	1 pint
KODAK EKTAPRINT R-5 Color Developer Replenisher	5 and 25 gallons
KODAK EKTAPRINT R-5 Bleach-Fix and Replenisher	5 and 25 gallons
KODAK EKTAPRINT 3/R-5 Bleach-Fix Regenerator Starter	1 gallon
KODAK EKTAPRINT R-5 Bleach-Fix Regenerator	25 gallons
KODAK EKTAPRINT R-5 Stabilizer and Replenisher	5 and 12½ gallons
KODAK EKTAPRINT Bleach-Fix Defoamer	8-ounce bottle

Precautions in Handling Chemicals

Notice: Observe precautionary information on containers and in instructions.

The developing agent used in this process may cause skin irritation. In case of contact of solutions with the skin, wash at once with an acid-type hand cleaner and rinse with plenty of water. The use of clean rubber gloves is recommended, especially in mixing or pouring solutions, and in cleaning the darkroom. Before removing gloves after each use, rinse their outer surfaces with acid hand cleaner and water. Keep all working surfaces, such as bench tops, trays, tanks, and containers, clean and free from spilled solutions.

The stabilizer contains formaldehyde, which is a skin and eye irritant. Provide adequate ventilation to prevent the accumulation of formaldehyde vapor in the vicinity of the solution or the drying area. Keep tanks tightly covered when not in use.

Contamination of Solutions

Both the photographic quality and the life of processing solutions depend upon cleanliness of equipment in which solutions are mixed, stored, and used. The contamination of any chemical solution by any other is to be avoided since it will seriously impair print quality. Take extreme care to avoid contamination of developer with bleach-fix during mixing and processing.

If metal processing or storage tanks are to be used with bleach-fix, they should be constructed of Type 316 stainless steel.

Avoid the mixing of chemicals in printing and processing areas, because the chemicals may cause spots on prints. Whenever a tank is drained, thoroughly clean and flush it with water before refilling.

Storage of Solutions

Store solutions at a room temperature of 24 to 29.5°C (75 to 85°F). For best results, do not use solutions stored longer than the following times:

KODAK EKTAPRINT R-500 Chemicals

	Full, Stoppered Glass Bottles	Partially Full, Stoppered Glass Bottles
First Developer	4 weeks	2 weeks
Stop Bath	8 weeks	8 weeks
Color Developer	4 weeks	2 weeks
Bleach-Fix	8 weeks	8 weeks
Stabilizer	8 weeks	8 weeks
Potassium Iodide (Stock Solution)	6 months	6 months

KODAK EKTAPRINT R-5 Chemicals

	Tanks with Floating Lids
First Developer Replenisher	2 weeks
Stop Bath and Replenisher	8 weeks
Color Developer Replenisher	2 weeks
Bleach-Fix and Replenisher	8 weeks
Stabilizer and Replenisher	8 weeks

Time and Temperature

Timing: Tray, drum, and tank processing require a timer with a sweep-second hand that can be followed in the dark.

The time required for each processing step includes the draining time. In each case, start draining in time to end the processing step (and start the next one) on schedule.

Temperature Control: Good results depend on accurate control of processing temperature, particularly during the development step. Recommended temperatures are included in the processing summary recommendations.

The ideal way of holding solution and wash-water temperatures at the proper level is with a thermostatic mixing valve. In tray or tank processing, the drain of the dark-

The soft, warm light of an early summer sunrise was used by Don Maggio to photograph his daughter in a field of ripening wheat. KODACHROME 64 Film captured the fine detail but, because of the lighting conditions, produced an excessively red transparency. This was easily corrected in making the Ektachrome print from which this reproduction was taken.

room sink can be fitted with a standpipe; then water can be allowed to overflow from the washing tray or tank and to surround the solution trays or tanks to the level of the standpipe.

As a substitute means of temperature control, an ordinary mixing faucet can be used. With such an arrangement, a thermometer placed in the water flow should be checked often to make sure that varying loads on the water supply lines do not change the temperature of the mixture.

One convenient arrangement is to connect the mixing faucet, through a rubber hose, to a wide-mouth flask or bottle fitted with a 3-hole stopper. The incoming water mixture is led to the bottom of the flask with copper or glass tubing. The outlet tube, on the other hand, projects only slightly below the bottom of the stopper. The third hole serves to hold the thermometer, which should be an accurate one.

Wash Water: When a 3½-gallon tank is used for washing, the KODAK No. 3F Washing Tank provides a convenient means of introducing the fresh water at the bottom of the tank. The minimum flow rate should be 2 gallons per minute in a 3½-gallon tank.

Eliminating Air Bubbles: When hot water is mixed with cold water containing large amounts of dissolved air, an effervescent wash water results. Prints in trays or tanks become covered with a layer of air bubbles that prevents adequate washing. If an aspirator (a common laboratory filter pump) is installed in the water line and adjusted to permit a steady flow of air into the wash water, the small bubbles will not form.

Processing Procedure for KODAK Rapid Color Processor, Models 11 and 16-K

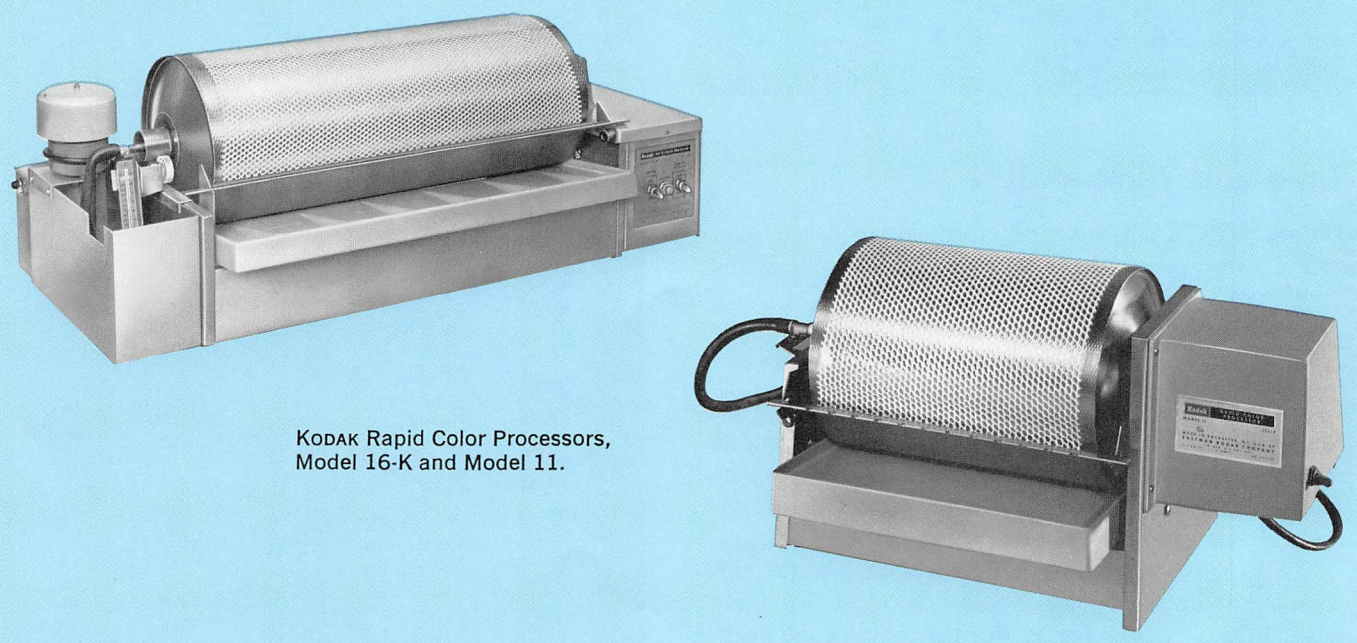
Note: The operation of these processors is covered in greater detail in the manuals supplied with the processors.

The epoxy-coated net blanket for the Model 16-K Processor may have to be trimmed in size for processing KODAK EKTACHROME RC Paper. The full-size blanket, overlapping the print being processed, may cause additional tension and may result in nonuniformity of development at the ends of the print. If this happens, or if streaking occurs, trim the blanket to the same width as (or slightly smaller than) the paper to be processed.

The rough coating on one side of the net blanket grips the smooth base side of the paper and prevents the paper from slipping off the drum. Be sure that the blanket is installed on the bar assembly so that the rough side will face the drum during operation, with the green end in the bar (one bar width) and the white end trailing.

The epoxy-coated net blanket for the Model 11 Processor is available as Part No. 500273, and the blanket for the Model 16-K Processor is available as Part No. 512093. Order from Eastman Kodak Company, Central Parts Service, 800 Lee Road, Rochester, New York 14650.

Maintain a drum temperature of 37.8°C (100°F) during the entire process. Best results depend on accurate control of temperature within plus or minus 0.3°C (½°F) during the first developer step. During the remainder of the process, maintain the drum temperature to within plus or minus 0.6°C (1°F).



KODAK Rapid Color Processors, Model 16-K and Model 11.

Summary of Steps for Processing in the KODAK Rapid Color Processor, Model 11 or 16-K, with KODAK EKTAPRINT R-500 Chemicals

Drum Temperature: First Developer Solution 38 ± 0.3°C (100 ± ½°F)
Other Solutions 38 ± 0.6°C (100 ± 1°F)
Washes 38 ± 1.1°C (100 ± 2°F)

Processing Step	Remarks	Model 11 Solution Volume		Model 16-K Solution Volume		Time in Min*	Total Min at End of Step
		METRIC	U.S. LIQUID	METRIC	U.S. LIQUID		
1. Prewet	In tray of water—total darkness†					1	1
2. First Developer	Total darkness	200 ml	7 fl oz	325 ml	11 fl oz	1½	2½
3. Stop Bath	Total darkness	200 ml	7 fl oz	325 ml	11 fl oz	½	3
4. First Wash	Use safelight No. 10 or OA	7.5-9.5 l/min	2-2½ gal/min	7.5-9.5 l/min	2-2½ gal/min	2	5
5. Color Developer	Use safelight No. 10 or OA	200 ml	7 fl oz	325 ml	11 fl oz	3	8
Remaining steps can be done in normal room light							
6. Second Wash	—	7.5-9.5 l/min	2-2½ gal/min	7.5-9.5 l/min	2-2½ gal/min	½	8½
7. Bleach-Fix	—	200 ml	7 fl oz	325 ml	11 fl oz	1½	10
8. Final Wash	—	7.5-9.5 l/min	2-2½ gal/min	7.5-9.5 l/min	2-2½ gal/min	1½	11½
9. Stabilizer	—	200 ml	7 fl oz	325 ml	11 fl oz	1	12½
10. Rinse	—	—	—	—	—	¼	12¾
11. Dry	See instructions 49 to 66°C (120 to 150°F)	—	—	—	—	—	—

*The time for each step, except the prewet, includes a 5-second drain time. The drain time after the prewet should be 10 seconds. In each case, start draining in time to end the processing step and start the next one on schedule.

†Agitate frequently. Do not handle the dry print with wet fingers or the wet print with dry fingers.

Important: After each process, rinse blanket, drum, and tray with running water to remove all traces of processing chemicals. Wipe excess water from drum and tray before starting next process.

Processing Procedure for Model 30A

Use the KODAK 2024A Processing Tube or the KODAK 3040A Processing Tube with the KODAK Rapid Color Processor, Model 30A or Model 30.

Processing procedures and maintenance recommendations are described in the operator's manual furnished with your processor. Familiarize yourself with that information and then proceed with these recommended instructions.

The process cycle times and solution requirements are listed, and a timing disk (either 50 or 60 Hz, depending on the power source) is used.

To process KODAK EKTACHROME RC Paper, Type 1993, the new spiral design processing tube (2024A or 3040A) must be used to produce satisfactory results. Load the tube in total darkness.

The color developer contains a chemical fogging agent that eliminates the need for a separate white light reexposure step. Never remove the processor tube cover until after the final rinse, otherwise there may be chemical streaks on the final print.

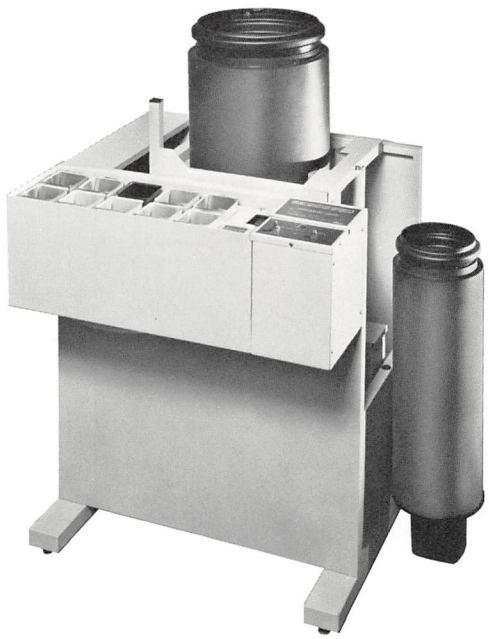
KODAK EKTACHROME RC Paper requires large volumes of wash water. A sufficient supply of water should be available to refill the containers.

Use a squeegee or sponge to remove moisture gently from both sides of the processed print. This provides faster drying and eliminates drying marks.

The processing of more than one sheet of KODAK EKTACHROME RC Paper at a time in the Model 30A or Model 30 is not recommended.

Filling the Containers with Processing Solutions: The stainless-steel containers are numbered and should be used for the processing solutions and water washes corresponding to the step number. To avoid contamination, do not interchange containers or container positions in the tempering bath.

Fill the containers (No. 1, 7, 8, 9, and 10) to the appropriate level (see summary of steps) with warm water and place each container in the proper compartment of the tempering unit. With the 2024A processing tube, one full container of water is needed for the third wash (container No. 9). To this wash, add 30 ml (1 fluidounce) of potassium iodide stock solution. Container No. 10 can be used for the fourth wash; immediately after use it should be refilled with warm water for the fifth wash.



KODAK Rapid Color Processor, Model 30A.

Fill the remaining containers to the appropriate level with chemical solutions as follows:

Container	Solution
2	First Developer
3	Stop Bath
4	Color Developer
5	Bleach-Fix
6	Stabilizer

Extreme care should be taken to avoid contamination of one solution by another. Wash the containers immediately after each step, and use the same container for the same solution each time.

With the 3040A processing tube, use containers No. 7 and 8 for the first wash, and refill the same containers for the second, fourth, and fifth wash steps. Containers 9 and 10 are needed for the third wash and require the addition of 30 ml (1 fluidounce) of potassium iodide stock solution to each container.

Because of the large volumes of wash water required, it may be difficult to get all the water into the cup of the processing tube cover within 10 seconds. If water is slow in draining from the top section of the cover, gently strike the side of the processing tube near the cover. This will displace the air pocket formed and allow the wash water to drain more rapidly.

Loading the Processing Tube: The manual for the processor explains in detail how to load the tube. The processing tube must be loaded in complete darkness. Once the processing tube cover is in place, the tube can be exposed to room light without danger of fogging the paper. Handle the tube carefully to avoid disturbing the position of the paper.

Place the loaded processing tube vertically in the cage of the processor. Check the temperature of the tempering unit water bath and the temperature of the contents of the containers. The "prewash" legend should be visible in the window of the timer.

Start by pouring the water of container No. 1 into the processing tube cover. Avoid splashing by holding the container inside the rim of the cover. (The solution will stay inside the cup of the processing tube cover until the tube is pivoted to the horizontal position.) Gently pivot the tube to the horizontal position and immediately press the process start button. The processing tube will start revolving and the process will be under way. When the timer buzzer sounds, immediately return the tube to the vertical position and add the solution in container No. 2 to the tube. Repeat this sequence for the remaining steps.

Tube Cleaning: After each process, rinse the processing tube and cover with warm water, not above 43.5°C (110°F). Before loading the tube for the next process, be sure that the inside of the tube is dry. Wet surfaces can prevent correct positioning of the paper.

Timing Disks: The KODAK EKTACHROME RC Timing Disk, Model 30A (60 Hz), Part No. 551346, and the KODAK EKTACHROME RC Timing Disk, Model 30A (50 Hz), Part No. 551347, are both available. Order from Eastman Kodak Company, Central Parts Service, 800 Lee Road, Rochester, New York 14650.

Temperature: The temperature of this process is nominally 37.8°C (100°F). Although the specific temperature of the first developer is 43 plus or minus 0.3°C (110 plus or minus ½°F), it will gradually drift downward to a nominal 37.8°C (100°F) during processing ambient 24°C (75°F) conditions. The water in the tempering unit must be adjusted, depending upon the ambient air temperature. The user will not normally adjust this temperature, since it is done automatically by the thermostat and temperature controls of the KODAK Rapid Color Processor, Model 30A. The thermostat is factory-adjusted to control the water in the tempering unit when the room temperature is 24 plus or minus 4.2°C (75 plus or minus 7°F). Any ambient conditions beyond this range will require adjustment of the thermostat adjusting screw. Carefully follow the procedures outlined in the processor manual for this adjustment.

Summary of Steps for Processing in the KODAK Rapid Color Processor, Model 30A, with KODAK EKTAPRINT R-500 Chemicals

Processing Temperatures: (75°F ambient room temperature)	First Developer Solution	43.5 ± 0.3°C (110 ± ½°F)
	Other Solutions	43.5 ± 0.6°C (110 ± 1°F)
	Washes	37.8 to 46°C (100 to 115°F)

Processing Step	2024A Processing Tube Solution Volume		3040A Processing Tube Solution Volume		Time (Min)*	Total Min at End of Step
	ml	fl oz	ml	fl oz		
1. Water Prewet	385	13	945	32	½	½
2. First Developer	385	13	945	32	1½	2
3. Stop Bath	385	13	945	32	½	2½
4. First Wash	945	32	1890	64	½	3
5. Second Wash	945	32	1890	64	½	3½
6. Color Developer	385	13	945	32	2	5½
7. Third Wash†	945	32	1890	64	½	6
8. Bleach-Fix	385	13	945	32	1½	7½
9. Fourth Wash	945	32	1890	64	½	8
10. Fifth Wash	945	32	1890	64	½	8½
11. Stabilizer	385	13	945	32	½	9
12. Rinse	385	13	945	32	¼	9¼
13. Dry—See Instructions—120 to 150°F (49 to 66°C).						

*All times include a 10-second drain time.

†Add 1 fluidounce (30 ml) of potassium iodide stock solution to each 32 fluidounces (946 ml) of wash water.

Processing Procedures for Small Tube-Type Processors

> **Tentative Information:** This information is based upon limited testing, is subject to change, and is intended only as a guide or starting point for the process described. The information has been carefully prepared and is believed to be accurate at the time of publication.

The introduction of small plastic tube-type processors by several manufacturers has prompted the following information for processing KODAK EKTACHROME RC Paper, Type 1993, using KODAK EKTAPRINT R-500 Chemicals. Owing to the variety of tube-type processors available, several portions of the processing cycle have to be calculated or determined by the user for his particular processor.

Two distinctive types of small tube-type processors are available:

Type A. These tubes are designed to be used without a constant-temperature water bath. Their solution inlets and outlets are open and would allow water to enter if they were used in a water bath.

Type B. These tubes are designed for processing in a constant-temperature water bath. Their solution inlets and outlets are either closed or positioned in such a way that the tempering water is prevented from entering the tube.

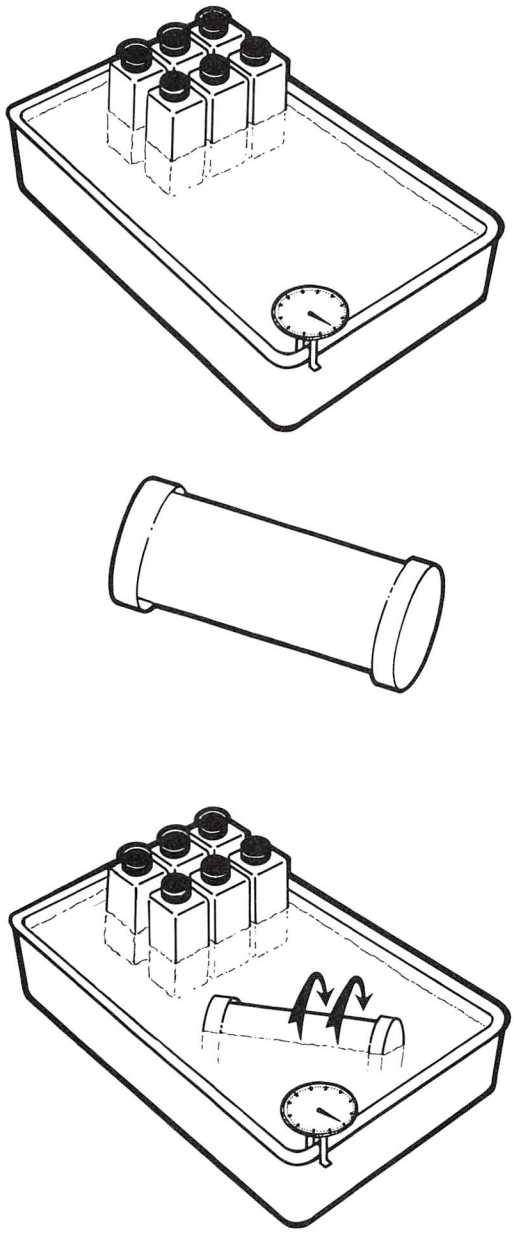
It is essential that none of the tempering water enter the tube during the processing procedure.

Select the processing procedure that is appropriate for the type of tube you are using.

Other Processing Equipment: In addition to the drum-type processor, you will need the following equipment: an accurate thermometer, a clock with a second hand, five chemical containers large enough to hold the amount of chemicals necessary for the size paper you are processing (label each container and use it only for that chemical solution), and a container for use as a constant-temperature water bath (large enough to hold the five containers of chemicals, a bottle of potassium iodide wash solution, and the processing tube itself, if it is a Type B processor). Containers should be made of glass, plastic, or Type 316 stainless steel.

Chemicals: KODAK EKTAPRINT R-500 Chemicals are recommended for processing KODAK EKTACHROME RC Paper, Type 1993, in small tube-type processors. The addition of approximately 0.2 gram per liter of potassium iodide to the wash water preceding the bleach-fix is recommended to prevent excessive stain. Since the amount of potassium iodide required in the wash is not critical, it is convenient to add the potassium iodide to the water in the form of a stock solution, just prior to processing. See page 16 for instructions on preparing the stock solution.

Determining Processing Solution and Wash Water Volumes: The volume of chemical solution and wash water necessary to process a sheet of KODAK EKTACHROME Paper properly in a tube-type processor depends upon the size of the tube. The size of the tube is defined by the largest single sheet of paper that can be processed in it. For example, a tube that can process nothing larger than an 8 x 10-inch sheet is an 80-square-inch tube.



The processing solution volume is calculated by multiplying the tube size by 0.8 ml and rounding up to the nearest 10 ml. For example, 80 in.^{2} x 0.8 = 64 ml rounded to 70 ml of processing solution for an 8 x 10-inch sheet of paper.

The wash water volume is twice the processing solution volume rounded up to the nearest 50 ml. Thus wash water volume for an 8 x 10-inch sheet of paper is 150 ml.

The chart below outlines the liquid volumes for popular sheet-sizes of paper.

Paper Size	Tube Size (square inches)	Liquid Volumes in ml	
		Processing Solution	Wash Water
8 x 10	80	70	150
11 x 14	154	130	300
16 x 20	320	260	550

Conserving Chemicals: With some processing tubes it *may* be possible to use less than the suggested volumes of each chemical solution. The suggested volumes contain sufficient safety factors to accommodate the wide variety of tube-type processors available. They also are sufficiently large to minimize agitation effects. A user may, for a particular processor, reduce the volumes of solutions used per run in an attempt to maximize solution usage. If you do this, be aware that as the solution volumes are reduced, agitation becomes more and more critical and repeatability becomes harder to maintain. Do not reduce the wash volumes and do not reduce the chemical solution volumes below 0.6 ml per square inch of paper. In order of increasing sensitivity to volume reduction, the chemical solutions are: stabilizer, stop bath, bleach-fix, color developer, and first developer.

Determining the Necessary Number of Washes After the Bleach-Fix: It is important for proper processing of EKTACHROME RC Paper that the bleach-fix solution be washed away after it has removed all traces of residual silver from the emulsion. Use the following procedure to determine how many times the wash step after the bleach-fix must be repeated to provide the proper removal of chemicals.

Load the tube with a sheet of scrap photographic paper. Wet the paper and the interior of the tube with water. Drain the tube for 10 seconds and then add a solution volume of bleach-fix. Agitate the tube according to the manufacturer's instructions for 90 seconds. Drain for 10 seconds and add a wash volume of water. Agitate for a 30-second wash that includes a 10-second drain. Drain into a clear glass or bottle. Repeat the washing step a second and a third time and drain each wash into a separate clear glass or bottle. Look at the three containers against a white background. If the second container is as clear as the third, only two washes are required after the bleach-fix. If not, repeat the washing step and drain into another clear glass or bottle. Compare the fourth wash with the third. If they are equally clear, the processor requires three washes after the bleach-fix.

Determining the Proper Water Bath Temperature: The recommended processing temperature for processing KODAK EKTACHROME RC Paper, Type 1993, in KODAK EKTAPRINT R-500 Chemicals is 38°C (100°F). The type of processing tube that you are using will determine which of the following tempering procedures you will use.

Procedure A (for processing tubes designed to be used without a tempering bath): The processing steps, including agitation recommendations, should be done on a level surface (not in the constant temperature bath). The tube *must* be level (flat) to allow an even distribution of each solution.

Since this procedure is run outside the constant temperature bath, heat can be transferred between the processor and the surroundings. To obtain an average temperature of 38°C (100°F), conduct the following test:

1. Place a previously processed sheet of EKTACHROME RC Paper in the tube (this can be a scrap print).

2. Follow the prewet and first developer portions of the processing cycle (Steps 1 and 2), using the correct volumes and times. The prewet and first developer solutions (water can be substituted in the test) should be at the temperature of the constant temperature bath before the process is run.

3. At the end of the first developer step, collect the solution discarded from the tube and measure the temperature. For a 24°C (75°F) room temperature, the constant temperature bath is typically about 43.3°C (110°F) and the temperature of the first developer after the processing step would be about 32.2°C (90°F). The average of 43.3 and 32.2 is 37.8 and the average of 110 and 90 is 100.

4. Repeat this test procedure, raising or lowering the temperature of the constant temperature bath until the average of the first developer bath temperature, before and after the cycle, is 37.8°C (100°F).

This test procedure need only be done once for a given processor, provided the room temperature remains fairly constant. Use the bath temperature established by this test for all future processes. If the temperature of the room varies more than about 5°F for any reason (or season), repeat this test as experience dictates.

Procedure B (for processing tubes that are designed for use in a tempering bath): The processing steps, including agitation recommendations, should be done with the tube placed in the constant temperature bath. For complete, even processing of the paper, the tube *must* remain level (flat) while in the constant temperature bath to allow an even distribution of each solution.


HX-1653
NY HISTORICAL

This beautifully restored prize-winning 1931 Ford Model A Deluxe Pickup Car was photographed by John Stone on a completely overcast day. However, the bright fall foliage and the warm ruby red of the car body give a feeling of sunshine to the picture. Reproduced from a same-size Ektachrome print from a Kodachrome 64 slide.

With an average room temperature of 24°C (75°F), the constant temperature bath should be 38 ± 0.3°C (100 ± ½°F).

Agitation: Agitation is very important. Be sure to follow the procedure recommended by the manufacturer of the processing tube that you are using.

Miscellaneous Recommendations:

1. Do not reuse chemicals.
2. Always mix full volumes of solutions. Do not attempt to mix fractional volumes.
3. Thoroughly wash and dry the processor and containers after each process.
4. Make sure that the tube is drained after each step. In some cup-type tubes it may be necessary to (a) drain the tube, (b) tilt the tube 180 degrees, and then (c) tilt the tube back to the draining position.
5. Become totally familiar with the processing tube you are using. It may help you to run through a processing cycle using water only (no paper in the tube).

General Processing Specifications for Tube-Type Processors with KODAK EKTAPRINT R-500 Chemicals

Nominal solution temperature of 38°C (100°F)

Processing Step	Time in Minutes*	Accumulated Time in Minutes
1. Prewet (water)	½	½
2. First Developer	1½	2
3. Stop Bath	½	2½
4. Wash	½	3
5. Wash	½	3½
6. Color Developer	2	5½
7. Potassium Iodide Wash	½	6
8. Bleach-Fix	1½	7½
9. Wash	½	8
10. Wash†	½	8½
11. Stabilizer	½	9
12. Rinse (water)	¼	9¼

*All times include a 10-second drain (to avoid excess solution carryover). Some processing tubes may require a **slightly longer** drain time. Be sure to allow enough time to make certain that the tube is drained and to add the next solution **on time** for the next step. The next step **begins** when the solution contacts the paper.

†An additional step (new Step 11) may be required, depending on the processing tube you are using. To determine if this step is required, see page 23.

Important: Always clean and dry the processing tube thoroughly after each process to help prevent contamination.

Continuous Processing

Continuous processing of KODAK EKTACHROME RC Paper, Type 1993, in KODAK EKTAPRINT R-5 Chemicals can be done in many continuous reversal processors when certain specifications are met. The following information and recommendations further explain these details.

Paper Splicing: KODAK Paper Splicing Tape, Opaque (or equivalent), is recommended for splicing together rolls of RC paper. Splicing iron temperature of 149 to 163°C (300 to 325°F) with a splicer dwell time of 2 to 5 seconds results in a well-made splice.

Leaders: KODAK Paper Leader (or equivalent) is satisfactory for initial threading of a continuous processor; however, KODAK Machine Test Leader RC Paper (or equivalent) is used at all other times when water-resistant paper is processed in continuous-strand processors.

Bleach-Fix Regeneration and Silver Recovery

Significant savings and reduction of overflow wastes can be obtained by recovering silver and regenerating KODAK EKTAPRINT R-5 Bleach-Fix overflow solution. For further information, refer to the instructions on the label of the KODAK EKTAPRINT R-5 Bleach-Fix Regenerator and the instructions contained in Kodak Publication No. Z-112.

Processing Procedure for KODAK EKTAPRINT R-5 Chemicals

A number of prints can be processed simultaneously by the use of tanks. The usual tank size capable of accepting 8 x 10-inch paper prints holds about 13.2 liters (3½ gallons) of solution. KODAK No. 3F or No. 3FD Processing Tanks or KODAK Hard Rubber Tanks, 8 x 10, fulfill this requirement and have both covers and floating lids available as well. Stainless-steel tanks fabricated with solder containing tin should not be used.

Basket Processing: The most convenient way of handling 8 x 10-inch prints in quantity tank processing is with the KODAK Processing Basket. This is a stainless-steel frame designed to fit in a 3½-gallon tank and is divided into 15 compartments by means of plastic screen dividers. One sheet of paper can be loaded in each compartment. A stainless-steel cover is supplied with each basket. Basket processing of prints smaller than 5 x 7 inches is not recommended.

Prints larger than 8 x 10 inches can be processed in commercially available processing units. With larger size prints on KODAK EKTACHROME RC Paper, Type 1993, load only one sheet of paper per basket compartment.

Prints can also be suspended in X-ray-type, spring-loaded clip hangers. Channel-type hangers can be used for processing paper if handled carefully. Insert a sheet of paper into the channel of the developing hanger and lock it into place by bringing the clip down over the top edge of the print. Make sure that all four edges of the paper are within the channels.

Place the loaded hangers in a KODAK Developing Hanger Rack No. 40 and use KODAK Hanger Separators to prevent the hangers from swinging during processing. Always make sure that the hangers are dry before loading. Also, always wear clean cotton gloves to prevent fingerprints and/or paper damage.

Basket Processing Agitation: The proper agitation for basket processing of sheets of EKTACHROME RC Paper is a combination of nitrogen-burst and manual agitation in each processing solution.

When you immerse the basket in each processing solution or water wash, agitate the basket continuously by hand for at least 30 seconds; thereafter, agitate it for 5 seconds at 30-second intervals. Agitate the basket in the following manner:

1. Draw the basket to the front of the tank.
2. Lift the basket about 1 inch.
3. Push the basket to the back of the tank.
4. With the basket in the back position, lower it to the bottom of the tank.
5. Draw the basket sharply forward to the front of the tank again and repeat steps 2 to 5. Perform these steps rapidly so that each cycle takes only about 1 second.

The above agitation method requires a minimum back-and-forth movement of about ¼ inch. Do not lift the paper out of the solution, and make sure that the basket cover is on securely in order to prevent sheets of paper from rising out of the basket.

The initial 30 seconds of continuous hand agitation in each processing solution is needed to prevent screen patterns, even when you are using gaseous-burst agitation. If the initial hand agitation is impractical (it would be with large baskets), the nitrogen supply should be turned on continuously for the initial 30-second agitation period.

In order to provide uniform processing, gaseous-burst agitation is also needed in addition to manual agitation. Nitrogen-burst agitation is provided by a KODAK Gas Distributor (for KODAK Hard Rubber Tanks, 8 x 10), a KODAK Intermittent Gaseous Burst Valve, Model 90B, and a nitrogen gas supply.

Position the vertical risers of the KODAK Gas Distributor on the side of the tank away from the operator. Lower the processing basket into the tank. For proper orientation, the cutout portion of the basket should be away from the operator, and the emulsion side of the paper should face the operator.

With gaseous-burst agitation, use a 1-second burst every 12 seconds, at a pressure sufficient to raise the solution level about ⅝ inch with each burst. Be sure to use only nitrogen in the developers. You can use nitrogen or compressed air (free from oil) in the other solutions. For general information on this subject, see Kodak Pamphlet No. E-57, *Gaseous-Burst Agitation in Processing,* which is available free, upon request, from Department 412L, Eastman Kodak Company, Rochester, New York 14650.

Reel Processing Agitation: Reel agitation is identical to basket agitation except for the method of manual agitation. When using the reel process, agitate the reels continuously by hand for at least 30 seconds; thereafter, agitate them for 5 seconds at 30-second intervals. Proper agitation consists of a vigorous, rapid, up-and-down movement of about 2 inches, along with a movement toward the sides and ends of the tank. Do not lift the paper out of the solution.

Hanger Processing Agitation: When processing sheets in KODAK Film and Plate Developing Hangers, follow the agitation procedure recommended for reel processing. Use KODAK Hanger Separators to prevent swaying of the hangers during the agitation procedure.

Tray Processing: Agitation of EKTACHROME RC Paper, Type 1993, processed in photographic trays, is accomplished by interleaving the sheets of paper. For best results, especially with large sizes, process no more than three sheets at a time. With experience, however, you can handle up to six sheets satisfactorily. You must wear rubber gloves to avoid skin irritation from the processing chemicals.

In an 8 x 10-inch tray, 1 liter of processing solution is required for processing three 8 x 10-inch sheets at a time. Immerse the first sheet, emulsion side down, in the first developer; then add the second and third sheets (also face down), at 20-second intervals. (Identify the first sheet by clipping off or notching one corner.) Each 20 seconds thereafter, pull the bottom sheet out; place it on top, without draining; and reimmerse it completely in the solution. Twenty seconds before the end of the development time, remove the first sheet and allow it to drain for 20 seconds; then immerse it in the first stop bath solution. Transfer the other two sheets in the same manner, at 20-second intervals. Repeat this procedure in each of the other processing steps.

For other numbers of sheets up to a maximum of six, divide the number of sheets into 60 seconds to determine the immersion and agitation interval. For example, to process only one sheet, agitate the sheet by lifting and reimmersing it once each minute. With two sheets, immerse them 30 seconds apart; then lift and reimmerse one every

30 seconds. In no case should the drain time at the end of each step exceed 20 seconds. With more than three sheets, the drain will be shorter than 20 seconds.

Discard the developers after processing three 8 x 10-inch sheets (or an equivalent of 1.7 square feet) per liter of developer. You can use the other solutions in the trays up to the normal exhaustion point, which is seven 8 x 10-inch sheets (or an equivalent of 4 square feet) per liter of solution.

Reversal Exposure: When KODAK Processing Reels or KODAK Processing Baskets are used, it is not necessary to remove the EKTACHROME RC Paper from the reel or basket. Expose it for 15 seconds with a No. 1 photoflood lamp at a distance of 1 foot from each end of the basket or reel. When fluorescent lamps are used, increase the length of exposure by 3 to 4 times.

For other batch processing methods, when adequate reversal exposure light cannot be provided over the entire print surface, remove the prints from the wash and expose the emulsion side of each sheet for 15 seconds with a No. 1 photoflood lamp placed 1 foot away. After exposure, return each sheet to the wash until all have been exposed.

Caution: In use, photoflood lamps become quite hot and will shatter if any liquid is splashed on their surfaces. Place sheets of glass where they will protect the lamps from being splashed.

Washing: Provide an adequate supply of clean water at a normal processing temperature. Flow rate specifications are given with each processing cycle given in the instruction sheet.

In batch processes larger than 10 gallons, the flow per minute should be 1/10 of the tank volume, but no less than 5 gallons per minute. The first wash and final wash for a 10-gallon or larger batch process should consist of two wash tanks using a countercurrent flow. An alternative method for a 10- to 25-gallon process is to use one first wash tank and one final wash tank, and discard the water from the tank after each processing run.

If the prints become covered with small air bubbles during washing (which will decrease the washing efficiency), install an aspirator in the water line. This should eliminate the formation of small air bubbles on the print surface.

Cleaning of Equipment: Baskets, reels, and film hangers must be washed thoroughly after each processing run to avoid contamination on the next run. Wash the equipment for 10 minutes at a high water-flow rate.

If the wash tanks used in the processing are also used for cleaning and washing the baskets, reels, or other processing equipment, discard the water from the wash tanks and begin the cleaning operation with fresh water.

Summary of Steps for 3½-Gallon Sink-Line Processing with KODAK EKTAPRINT R-5 Chemicals

Temperature of First Developer: 29.5 ± 0.3°C (85 ± ½°F)
Temperature of all other solutions: 29.5 ± 1.1°C (85 ± 2°F)
First two steps must be done in **total** darkness.
Remaining steps may be done in normal room light.

Solution or Procedure	Comments	Processing Time* (minutes)	Total Minutes at End of Step
First Developer	Temperature tolerance ± 0.3°C (½°F)	4	4
Stop Bath		1	5
REMAINING STEPS MAY BE DONE IN NORMAL ROOM LIGHT			
First Wash	Running water at 3 to 4 gallons per minute	4	9
Reversal Exposure	Expose emulsion side for 15 seconds, 1 foot from No. 1 photoflood lamp		Reset Timer
Color Developer		4	4
Wash		1	5
Bleach-Fix		3	8
Final Wash	Running water at 3 to 4 gallons per minute	3	11
Stabilizer	See warning on label	1	12
Rinse	Agitate in running water	½	12½
Dry	Not above 93°C (200°F)		
	Total Process Time	21½	

*All times include a 15-second drain.

Replenishment

To produce high-quality prints consistently, replenish the working solutions after processing each batch of paper. This method will compensate for the use and aging of the solutions, thereby improving the control of density and color balance. Calculate the exact amount of replenisher needed and then add the replenisher to each tank solution just before processing the next batch of paper.

Before adding replenisher to the processing tanks, remove enough of the tank solution to make room for the replenisher. Add the calculated amount of replenisher to restore the proper solution level in the tank. When partially full baskets are run, solution carry-over may exceed the replenisher volume in the first developer. In this case, add enough replenisher to restore the proper solution level.

Note: Before each individual use, thoroughly clean equipment used for removing working solution and for measuring the replenisher in order to avoid contamination.

Basic Replenishment Rates

Processing Solution	Milliliters Per Square Foot
First Developer	70
First Stop Bath	140
Color Developer	140
Bleach-Fix	45
Stabilizer	70

If processing is suspended for more than one week, process and evaluate a control strip before processing any customer work. After shorter shutdown periods, always include a control strip in the first run to make sure that the process is in control. If the control strip indicates unsatisfactory results, it is likely that the developer solutions should be replaced.

For a successful replenisher operation, pay particular attention to the following:

1. Prepare the solutions according to the mixing instructions packaged with the chemicals. Make sure that the mixing tanks and equipment are clean and that the tanks are properly calibrated.

2. Make sure that all replenisher storage tanks are clean, clearly identified, and equipped with tightly fitting stoppers. To avoid contamination, do not interchange the stoppers. In large batch operations, equip the developer replenisher tanks with a floating lid, and use dust covers on all storage tanks.

3. When the process is not in operation, protect the working solutions from oxidation, contamination, and dust by placing a floating lid on each chemical tank, and be careful not to interchange the lids.

4. Do not exceed the maximum recommended storage times of the solutions.

Processing in a Nonreplenished Batch Operation: Without replenishment, each gallon of solution will process about 13½ square feet of paper (approximately equivalent to 24 sheets of 8 x 10-inch paper or 46 linear feet of paper 3½ inches wide). In each 3½-gallon tank, you can process approximately 84 sheets of 8 x 10-inch paper or eight full KODAK Processing Reels (each reel containing paper 3½ inches wide by 20 feet long). Discard all solutions when you reach this capacity or when the solution storage life has been exceeded, whichever comes first.

Drying

Rolls of prints on KODAK EKTACHROME RC Paper, Type 1993, can be dried on conventional drum dryers, emulsion side out, or on air impingement dryers such as the KODAK Roll Paper Air Dryer, Model 2. The temperature should not be above 93°C (200°F). Be sure that all surface moisture is removed from the paper base before it comes into contact with the drum surface. Do not ferrotype EKTACHROME RC Paper in rolls and do not dry it in a heated continuous-belt dryer. Strips can be dried in the KODAK Processing Reel. A glossy surface will result if warm air is circulated through the reel.

Caution: Do not heat plastic reels above 54°C (130°F). Strips and rolls dried at room temperature will usually have a slightly lower gloss.

Sheets of KODAK EKTACHROME RC Paper can be dried in hot-air impingement dryers, yielding a gloss comparable to that of ferrotyped prints. Among manufacturers of air impingement dryers are the following:

Arkay Corporation
228 South 1st Street
Milwaukee, Wisconsin 53204

Pako Corporation
6300 Olson Memorial Highway
Minneapolis, Minnesota 55440

Sheets processed in film hangers can be dried in the hangers, or the prints can be removed and placed, emulsion side up, on racks made of plastic screening or cheesecloth stretched and tacked to the edges of wooden frames. By attaching small wooden spacers to these screened racks, many racks holding prints can be stacked. The size of prints dried on these racks is limited only by the size of the racks themselves. Forced circulation of filtered warm air, not above 107°C (225°F) will hasten rack drying, as well as improve the surface gloss of the paper. Squeegeeing both sides of the print will also help minimize the drying time, but care should be taken to avoid abrasion of the emulsion surface. Squeegeeing also helps prevent uneven drying patterns. (Some workers prefer to remove surface moisture carefully with a viscose sponge dampened with stabilizer solution, in order to produce a higher surface gloss under forced warm-air drying conditions.)

Never place prints between blotters or with the emulsion in contact with a blotter roll, because the soft, wet emulsion will adhere to the blotter surface.

KODAK EKTACHROME RC Paper *cannot* be dried by placing the emulsion side in contact with a ferrotype or textured dryer surface, because the moisture present in the emulsion cannot escape through the base, and the result is sticking or prolonged drying times.

Color Printing Controls

The same printing controls used in black-and-white or color-negative enlarging can be used in making color prints on KODAK EKTACHROME RC Paper, Type 1993, with one big difference: *they work in the opposite direction*. An area can be dodged to darken it or printed-in to lighten it. For example, a heavy shadow can be lightened by giving the area more exposure time than the rest of the picture, or a sky can be darkened by shading it during a portion of the exposure time.

The basic tool for dodging is an opaque card of appropriate size and shape fastened to the end of a stiff wire; for printing-in, it is a larger opaque card containing an opening of appropriate size and shape. (Do not use the commercially available tools made of red acetate.) In either case, the tool is held in the light beam, between the lens and the paper, and is kept in motion during the exposure to avoid producing a sharp line of demarcation in the print. For best results, it is generally advisable to practice the control measure in advance of making the actual exposure. Use of these color printing controls can be overdone. For example, shadow areas containing little detail should not be printed-in at all—it is better to let them go dark in the print than to make them smoky and unreal.

CC (not CP) filters cut to the proper shape add a valuable tool to color-printing control. A common instance of their need is excessive blue in the shadow under a tree or along the side of a building. The remedy is to keep a *yellow* filter in motion over that area during part of the print exposure. Similarly, a brick-red face tone can be corrected by using a *cyan* filter. In general, a CC30 to CC50 density is suggested. A weaker filter may not have enough effect, and if the filter is too strong, it can simply be used for a smaller part of the exposure. (If you are accustomed to making color prints on KODAK EKTACOLOR 37 RC Paper, from color negatives, you may find that it takes more color-dodging time to accomplish the desired result with KODAK EKTACHROME RC Paper, Type 1993.) Since color dodging also affects print density, it may be necessary, at times, to burn in the dodged area with the same color filter, in order to lighten it to its original density while maintaining the desired color correction. This is done by placing the dodging filter over the hole in the large, opaque burning-in card.

There are many other situations in which local print control can enhance a good photograph. The colors of faces, dresses, buildings, and many other areas can be shifted, intensified, lightened, or darkened so easily that local control should often be considered simply to make the picture more interesting.

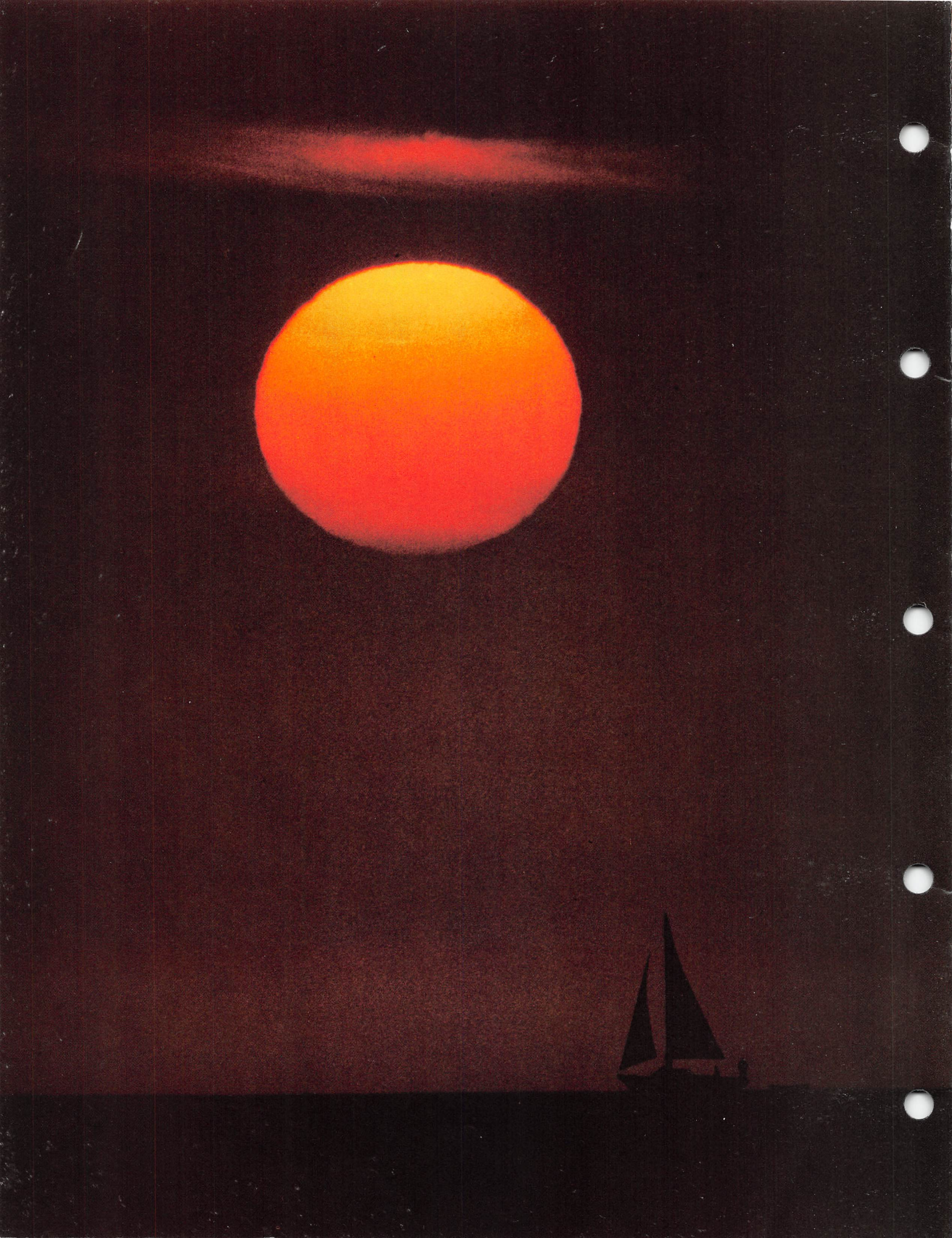
Multiple-Image Printing

An excellent way of creating new compositions from existing color transparencies is to combine images into a single print on KODAK EKTACHROME RC Paper, Type 1993. Not only can multiple images be produced, but texture can be added to a print, clouds and color can be added to a bald sky, a foreground silhouette can be added to an overly two-dimensional composition, and many other creative combinations can be obtained.

There are two methods of printing multiple images on EKTACHROME Paper—printing sandwiched transparencies and combination printing. The choice of method depends upon the effect you wish to create. If you want to put details from one scene into the *highlights or upper middletones* of another scene, you should print with sandwiched transparencies. If you want to put images from one scene into the *shadows* of another scene, you must make a combination print. Because your original subjects are on color transparency film, there are no superimposed colored coupler masks to contend with and, if the originals are on the same type of transparency material, no filter-pack changes to make. Multiple-image printing with color reversal materials is much easier than it is with color negatives.

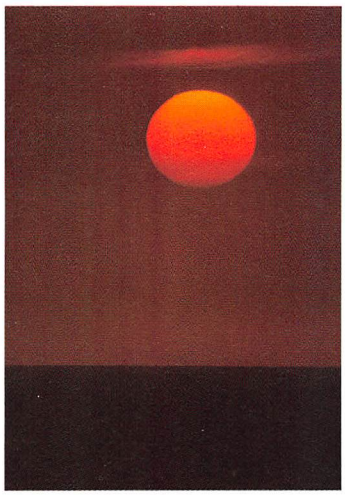
Sandwiched Transparencies

Two unrelated transparencies sandwiched and printed on KODAK EKTACHROME RC Paper, Type 1993. Note how the relatively underexposed sunset completely dominates the pale blue sky behind the boy and his blue and yellow kite. Photographs (on KODAK High Speed EKTACHROME Film) and print by Ralph Cowan.

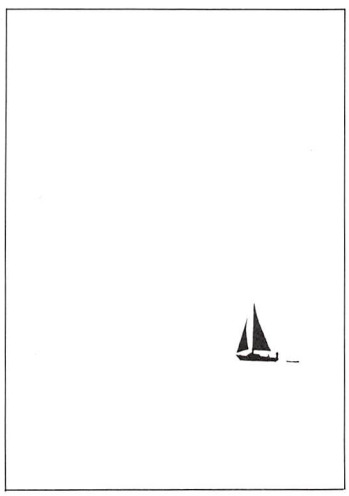


Printing Sandwiched Transparencies

The simplest method of producing a multiple-image print is to select a transparency that has relatively large areas of highlight for use as a background, and a transparency in which the subject is fairly isolated in a high-key surround. Overlay the two unmounted transparencies, emulsion to emulsion, on a transilluminated viewer or light table. Arrange the composition so that the subject of one is located in the highlight area of the other. Use black masking tape to bind the two transparencies together in position, and as an opaque mask on all four sides to prevent unwanted areas from printing. Since the transparencies are bound with both emulsions facing in, position the sandwich in the enlarger carrier in whichever orientation makes the most pleasing composition. If three transparencies are sandwiched, keep those with the most important details in the same focal plane by placing their emulsions together.



Sandwiched Films
Another frame from the roll that produced the background for the illustration on page 31 was used by photographer Ralph Cowan as the impressive setting for this combination of high speed Ektachrome transparency and tiny Kodalith negative of a sailboat. Note how reduction of the subject size produces the effect of an extreme telephoto lens.



You may find that the basic filter pack will need adjustment and that the normal printing time will be extended. Remember that unwanted details can be subdued by dodging and that important areas can be lightened by burning-in, when necessary.

Combination Printing

This technique, often called double printing, consists of making multiple-image prints from two or more transparencies onto a single sheet of EKTACHROME Paper by means of separate exposures.

In color-reversal printing, the dark areas of a print are the relatively unexposed areas; therefore, it is possible to project a second image into the shadows of a first image.

Proceed as follows:

1. Make a plan of the composition by projecting the transparencies, in turn, onto a sheet of thin white paper taped in place on the easel. With a soft pencil, trace the main elements of the transparencies onto the paper.

2. Leaving the paper plan taped on the easel, make test prints of the component transparencies.

3. Evaluate the test prints and list the necessary changes.

4. Place a sheet of EKTACHROME Paper on the easel and start the combination print with the exposure of the background transparency. If the test print showed any excess detail in the shadow area to be imprinted, dodge that area with an opaque card (see page 30).

5. Remove the EKTACHROME Paper from the easel and place it in a dark drawer, first marking a corner for orientation reference. (Clip the corner with a pair of scissors, or if you are making a borderless print, attach a paper clip.)

6. Compose the second transparency, using the paper plan for position. Change the enlarger settings, if necessary.

7. Replace the sheet of EKTACHROME Paper in the easel in the same orientation, and make the second exposure. Use an opaque card with a hole in it to prevent unwanted exposure in areas containing only background exposure (see page 30).

8. Remove the exposed EKTACHROME Paper for processing.

Combination prints containing elements from many transparencies can be produced in this manner if care is taken to limit the imprint exposures to carefully planned areas and if all extraneous light is eliminated from the easel.

Contrast Control

The most favorable condition under which a color picture can be viewed is by projection, in positive transparency form, in a dark room. The screen becomes an isolated patch of colors with a completely dark surround. Under these conditions, the eye adapts to the overall color balance and to the color saturation of the transparency, making the reproduction appear more nearly correct than it really is. To lesser degrees, this is true of a transparency viewed over an illuminator in a partially darkened room or in a well illuminated room. Reflection color prints, however, are viewed in normal surroundings, usually under uniformly distributed illumination, and have all the visual effects working to make obvious any faults which the print may have, either in color balance or in contrast. Comparison of a print and a transparency of the same subject, therefore, is biased against the print.

KODAK EKTACHROME RC Paper, Type 1993, is matched to the normal contrast characteristics of most color transparency films. Occasionally, however, a subject is encountered that would reproduce better at a contrast level different from that afforded by straight transparency-to-paper printing. In such cases, the following methods can be used to modify the printing characteristics of the problem transparency.

Contrast Reduction

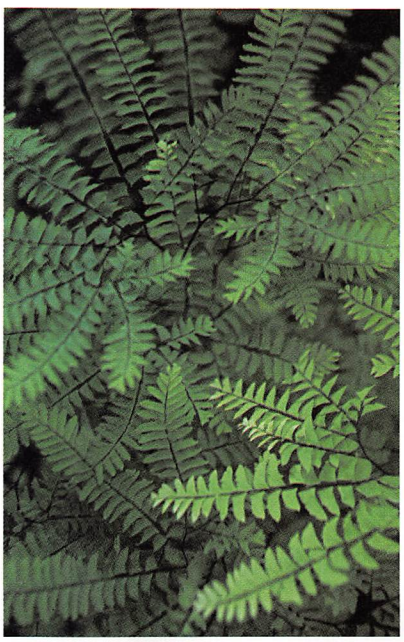
Two methods of contrast reduction are available: flashing and silver masking. The choice of method depends upon both the severity of the correction and the time element and cost factor.

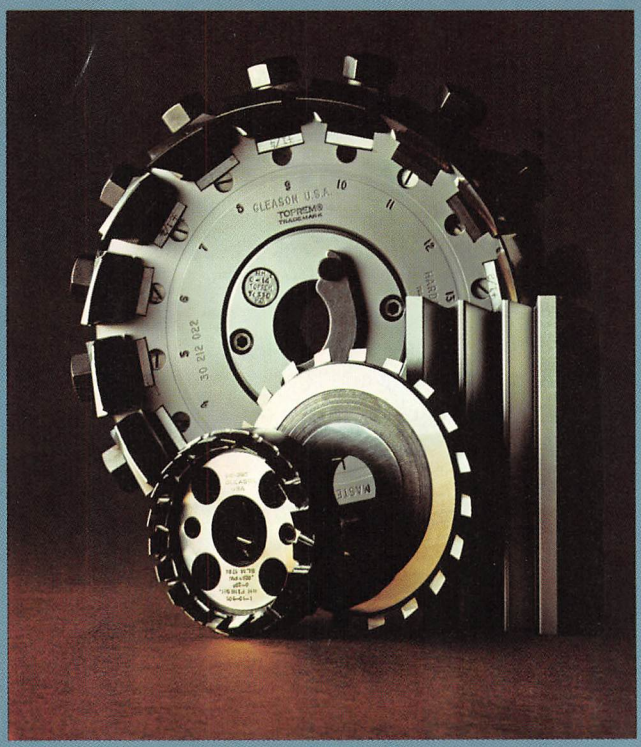
Flashing: The easier of the two methods is simply to flash the color paper after making the original exposure. Remove the transparency from the enlarger and add a neutral density filter (such as a KODAK WRATTEN Neutral Density Filter, No. 96) of a 2.0 value to the filter pack. Try a test exposure equal in time and lens aperture to the original exposure. Vary the density of the neutral density filter or the exposure time to produce the desired result with your equipment. You may find that some correction of the color balance of maximum-density areas is possible with the flashing technique by changing the printing filter pack balance toward the desired color.

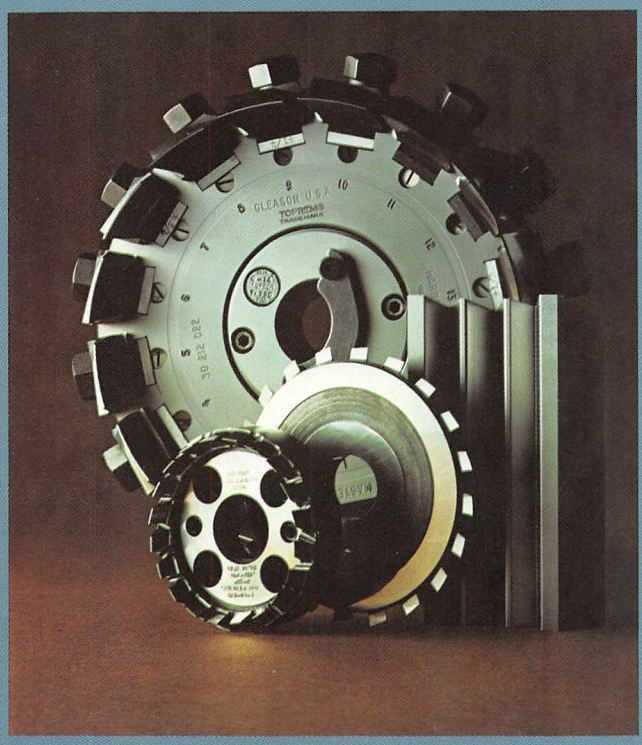
This technique is limited in the amount of contrast reduction possible. Overflashing will fog the shadows and middletones, giving a smoky effect, with no increase in visible detail.

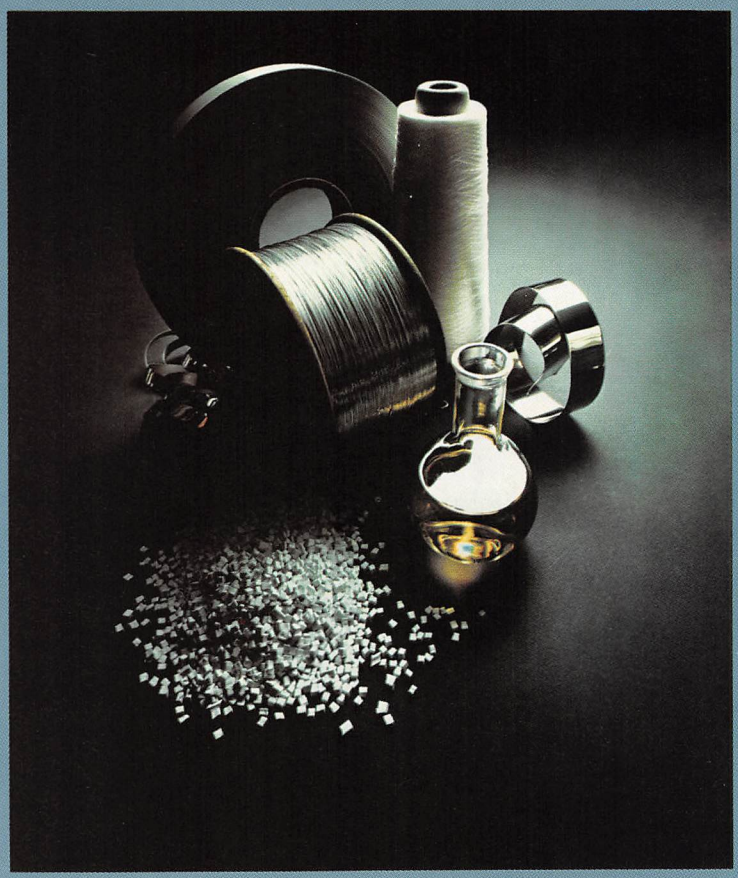
Combination Print

This print was made by Ken Starr, following the procedure outlined on page 33. He exposed the portrait transparency first. Then, using a mask cut to the shape of the head and shoulder to hold back areas of the fern, he exposed the background. Because the portrait background was black, no mask was needed to protect the fern image. The portrait was made by Neil Montanus; the background photo was made especially for this portrait by Frank McLaughlin.





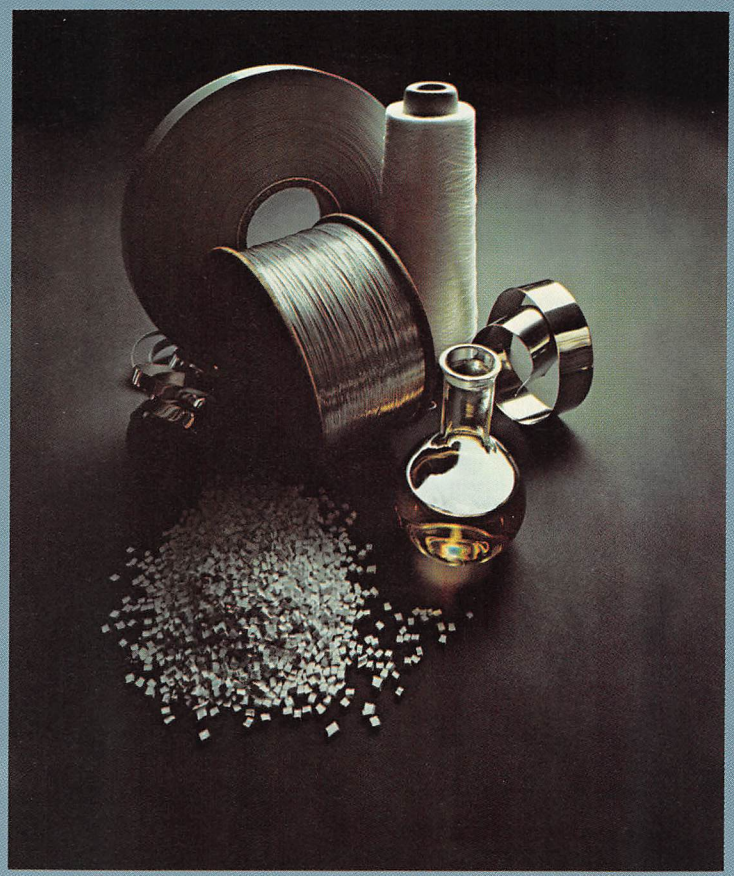


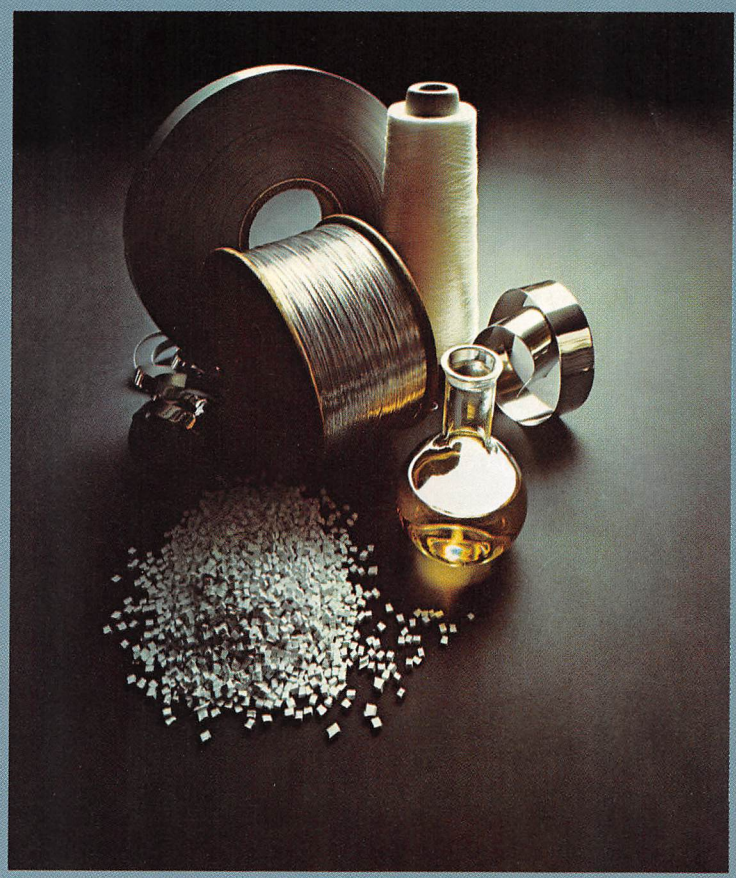


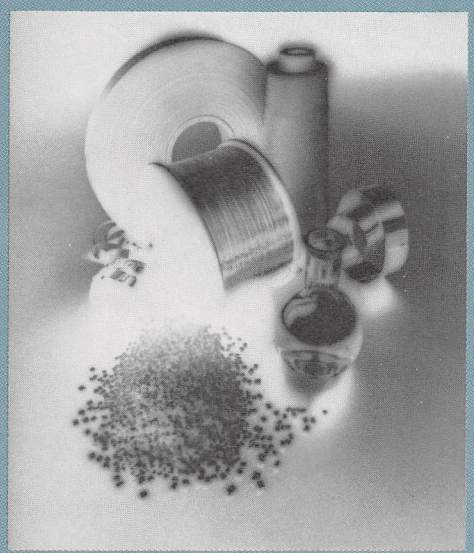
Contrast Reduction

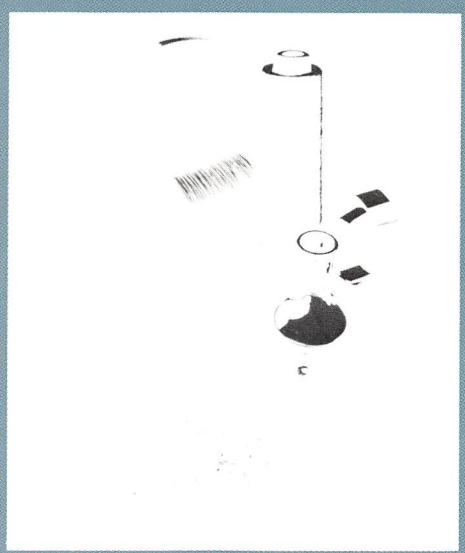
Left: Results of post-exposure flashing, using 2 percent of the original exposure. This was achieved by including KODAK WRATTEN Filters, No. 96, equalling 1.70 in density and duplicating the original exposure time. Because the background appeared excessively reddish, a CC30 cyan filter was added for the flash exposure. The top print is unflashed.

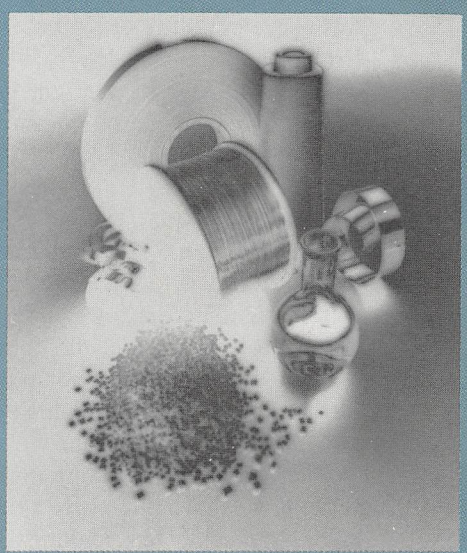
Right: Results of two methods of silver masking. Above is an unmasked print. Above center is the result of using the contrast reducing mask at near right. Above right, the result of using a highlight mask (right center) to produce the contrast reduction mask at far right. Notice the improved highlight and midtone rendition. The original 4 x 5-inch Ektachrome transparencies were made by Steven Kelly for Gleason Works Incorporated (left) and the Schlegel Corporation. Prints by Ken Starr.











Silver Masking: A more controllable and effective method of contrast reduction is to use a black-and-white sheet film of low contrast to mask the highlight areas of the transparency so that its density range will more nearly match that of the EKTACHROME Paper.

This masking method can also be overdone, and a print with flat highlight areas lacking in detail will result. The ultimate masking method consists of a contrast reducing mask that has been modified with a highlight mask.

Making the Negative Mask: The negative mask is made by contact-printing the color transparency on a sheet of KODAK Pan Masking Film 4570. It is convenient to use a tungsten enlarger as the light source and to make the exposure on the easel. The mask image is diffused with a KODAK Diffusion Sheet and a piece of clear glass. A ⅛-inch thickness of glass is used for transparencies 5 x 7 inches to 2¼ inches square; a ¼-inch thickness of glass is used for transparencies larger than 5 x 7 inches; and for 35 mm transparencies, the KODAK Diffusion Sheet alone will suffice. For exposing the mask, the films, glass, and diffusion sheet are arranged as shown in the diagram.

Exposure: With the lens set at the largest opening, adjust the illumination to give 3 footcandles at the easel by raising or lowering the enlarger head. Stop down 4 stops. The exposure time varies with the transparency density. Try an initial exposure time of 8 to 10 seconds. Adjust the exposure so that there is no image in the shadow areas.

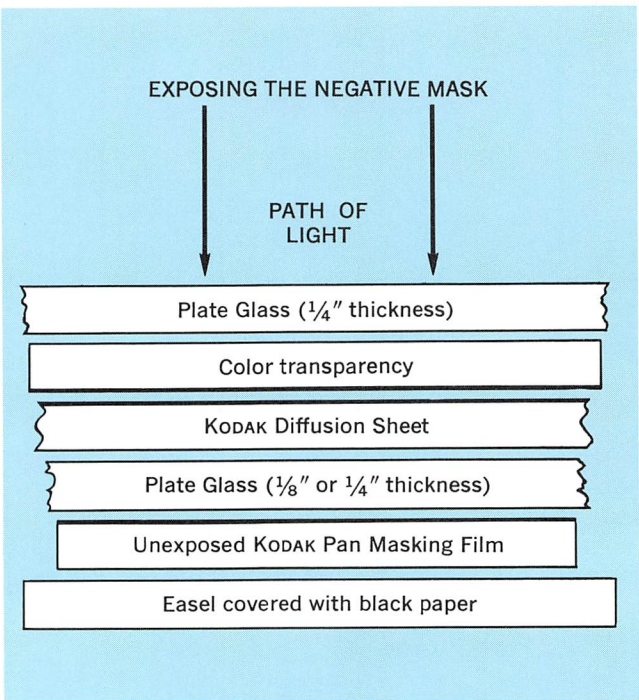
Development: Develop the exposed mask for 3 minutes at 20°C (68°F) with continuous agitation in a tray of fresh developer. Either KODAK Developer DK-50 (1:4) or KODAK HC-110 Developer, Working Dilution F, is recommended. Do not extend the development time to compensate for inadequate exposure. Rinse, fix, wash, and dry the mask as described in the film instruction sheet.

Highlight Masking: The highlights fall somewhere along the toe portion of the characteristic curve in many KODACHROME and EKTACHROME Transparencies; their contrast is therefore lower than that of the middletones. When a print is made, the contrast of the highlights in relation to that of the middletones tends to be lowered further because the highlights again fall on a flatter portion of the characteristic curve.

With subjects containing important highlight areas, it is often worthwhile to correct this error by introducing a highlight mask before making a contrast reduction mask.

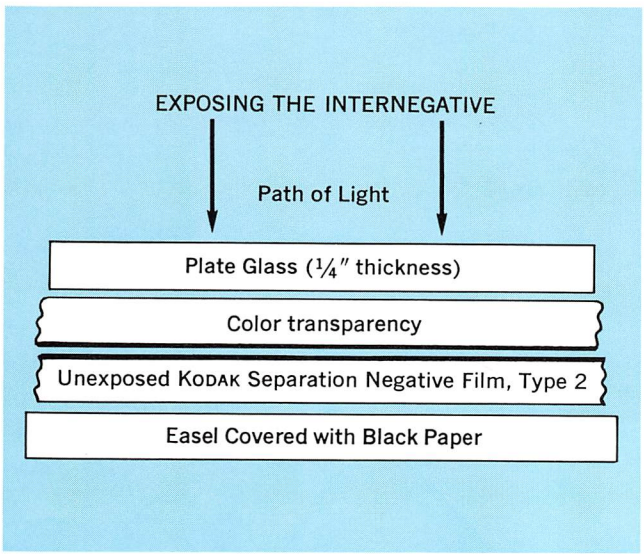
First the transparency is printed by contact on KODALITH Ortho Film, 2556, Type 3 (ESTAR Base), or equivalent, with the exposure adjusted so that an underexposed negative is obtained. After development to high contrast in a developer such as KODAK Developer D-11, this mask will contain densities corresponding to the highlights of the transparency only; other areas will be clear. The highlight mask is registered with the transparency; from the combination, the contrast reduction mask is made. Since the highlights of the transparency have density added to them by the highlight mask, they are printed on the contrast reduction mask very much lighter than they would be without the highlight mask.

After the contrast reduction mask has been developed, the highlight mask is removed from the transparency and replaced with the contrast reduction mask during the exposure of the EKTACHROME Paper. The contrast of the highlights is now relatively higher than normal. The highlights should therefore reproduce in the print with the desired sparkle and brilliance.



Exposure: As with contrast reducing masks, use a tungsten enlarger as the light source and make the exposure on the easel (or use a contact printing frame). The masking film and the transparency are exposed emulsion-to-emulsion without an acetate spacer. The exposure of the highlight mask is fairly critical. If the light source is an enlarger that has been given an illumination level of 3 footcandles at the easel with the lens at *f*/4.5, stop the lens down to *f*/22 and add a neutral density of 1.0 (KODAK WRATTEN Neutral Density Filter, No. 96). Give a trial exposure of 10 to 20 seconds.

Processing: Masks on KODALITH Ortho Film, Type 3 (ESTAR Base), can be developed by inspection, using a safelight fitted with a KODAK Safelight Filter No. 1A (light red), or equivalent. Develop the film, with continuous agitation, for 2½ to 3½ minutes at 20°C (68°F) in a tray of KODAK Developer D-11, full strength. After development, rinse the film for about 10 seconds in a stop bath such as KODAK Indicator Stop Bath or KODAK Stop Bath SB-1a. Fix the film for 2 to 4 minutes in a fixer such as KODAK Fixing Bath F-5 or KODAK Fixer, or for 1 to 2 minutes in KODAK Rapid Fixer. Wash the film for about 10 minutes in running water. *Use a temperature from 18 to 21°C (65 to 70°F) for rinse, fix, and wash.* To minimize drying marks, treat the film in KODAK PHOTO-FLO Solution, or equivalent, after washing, or wipe the surfaces carefully with a soft viscose sponge. Dry the film in a dust-free place with no more than moderate heat.



Registering the Mask: Register the highlight mask on the emulsion side of the transparency. Use strips of tape to fasten the mask to the original. Be careful to let the tape touch only the extreme edges of the transparency. The mask gives a rather strange appearance to the transparency, but this is normal. The temporary reversal of the highlights will disappear when the highlight mask is replaced by the contrast reduction mask.

The contrast reduction mask is made in exactly the same way that it would be if there were no highlight mask on the transparency. After the contrast reduction mask is made, the highlight mask is removed and replaced by the contrast reduction mask.

After some experience with highlight masking, you will find it fairly easy to judge whether correct exposure has been given. If the mask is underexposed, the desired highlight-tone correction in the print will not be obtained. Overexposure will extend the increase in contrast to the lighter middletones, and will result in a harsh effect in the print.

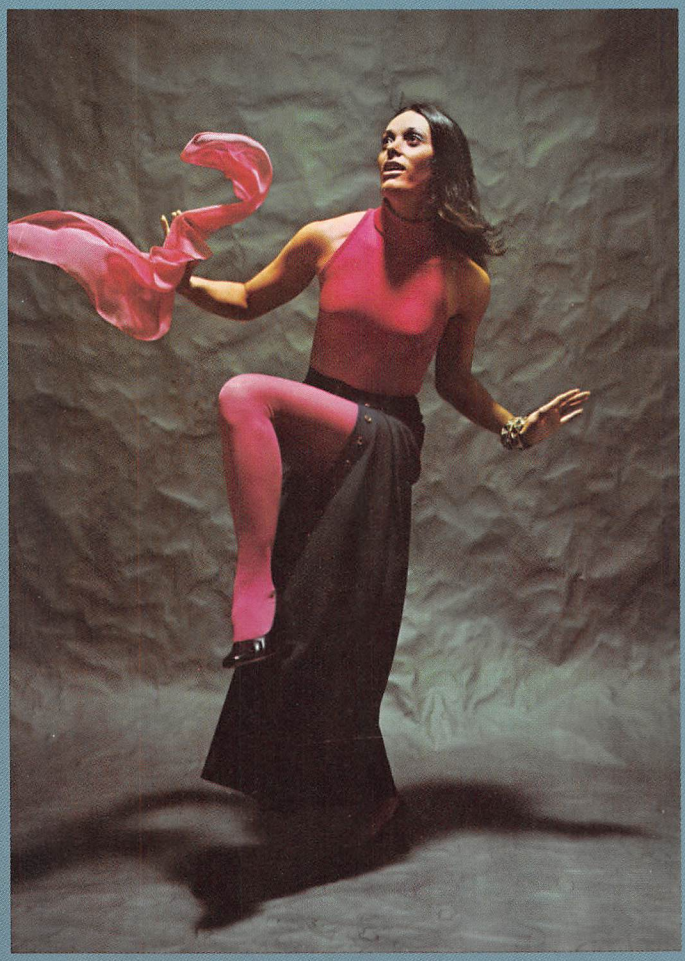
Contrast Increase

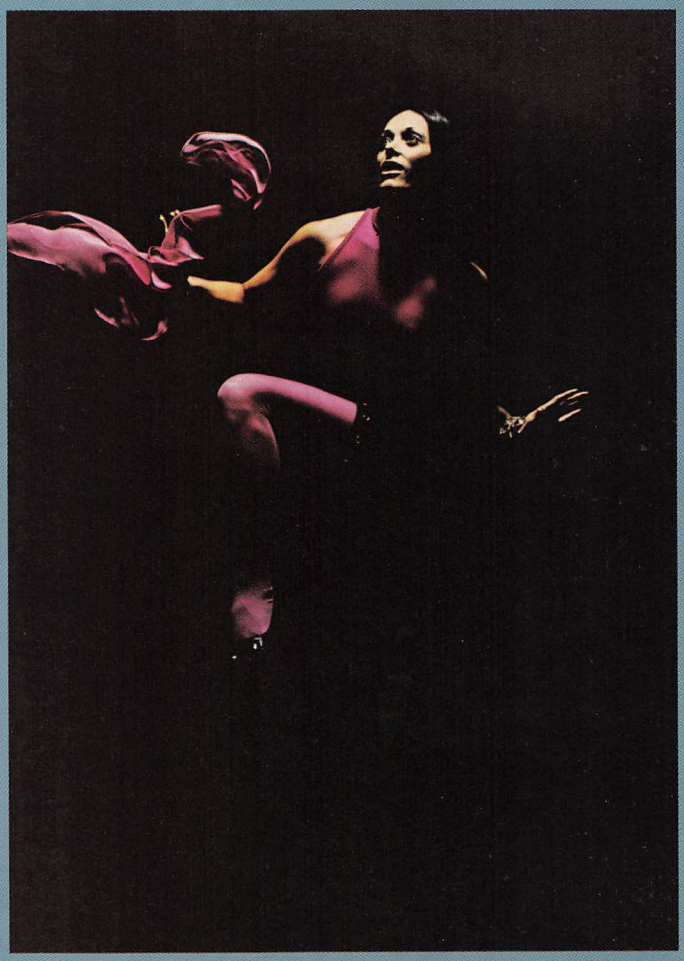
It is rarely necessary to increase contrast in color-reversal printing, since lowering exposure will cause an increase in shadow density. Occasionally, however, a transparency may be encountered that is too low in density to be controlled by exposure. The cause may be overexposure, camera flare, or unusually low lighting ratio in the illumination of the original scene. (Unusual dramatic lighting effects can also be imitated by strongly overmasking with this technique.) To achieve an increase in print contrast, a positive silver mask can be added to the transparency, adding density to the shadow and lower middletone areas, without affecting the highlight and upper middletones. Before the positive mask can be made, an internegative mask must be made first.

Making the Internegative Mask: With the lens set at the largest opening, adjust the illumination level to give 3 footcandles at the easel. Stop down 4 stops. Contact-print the transparency on KODAK Separation Negative Film 4133, Type 2, or equivalent, emulsion to emulsion. There should be no diffusion sheet or glass between the transparency and the separation negative film. Try an initial exposure time of 8 to 10 seconds. Adjust the exposure to obtain a clean, crisp negative image with good detail in both highlight and shadow areas. Develop the internegative mask in undiluted KODAK Developer DK-50, or equivalent, for 4 minutes at 20°C (68°F). Do not extend the development time to compensate for inadequate exposure.

Making the Positive Silver Mask: Using the same illumination setup and lens stop, contact-print the internegative mask on KODAK Separation Negative Film 4133, Type 2, or equivalent, with the emulsion side of the internegative mask facing the emulsion of the separation negative film. Use no diffusion sheet. Try an exposure time of 1½ seconds, and develop the mask in undiluted KODAK Developer DK-50, or equivalent, for 4 minutes at 20°C (68°F). A satisfactory positive mask will appear underexposed, with no density in the highlight and upper middletone areas. The shadow areas will have the desired density.

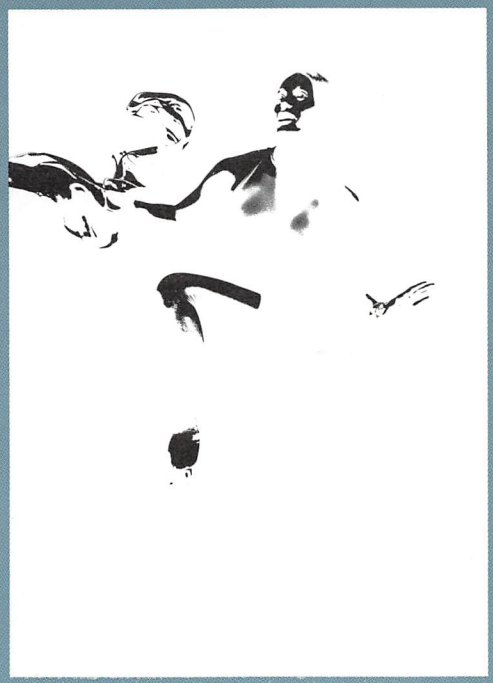
Printing the Masked Transparency: For printing on the EKTACHROME Paper, tape the silver positive mask in register on the base side of the color transparency and place the combination in the enlarger carrier with the emulsion side of the transparency down as usual.

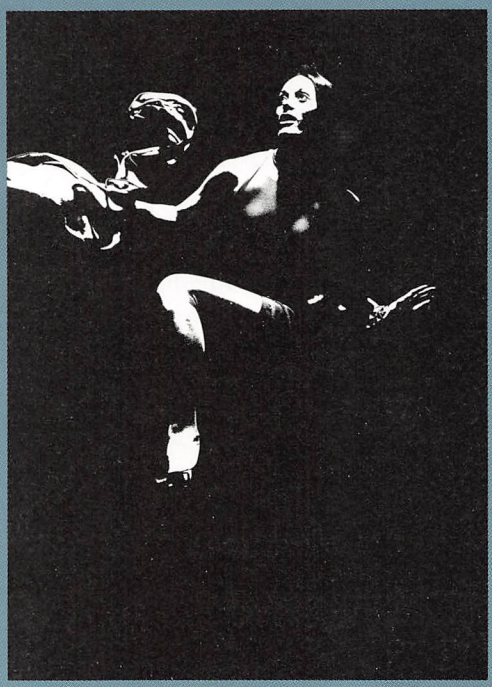


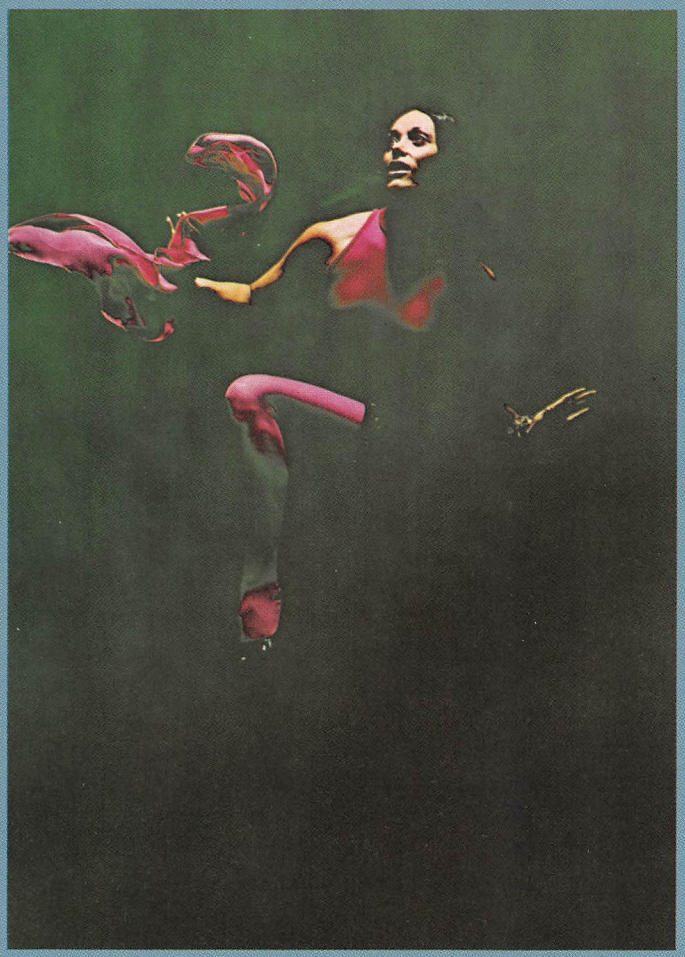


Contrast Increase

Change, rather than improvement, was the goal of this series of prints. The original 8 x 10-inch Ektachrome transparency by Lee Howick was lighted dramatically and the straight print, above left, is a good reproduction. However, by employing the high-contrast silver masks at right, printer Ken Starr first removed the background by excluding it from exposure with the positive mask. Then by using the negative mask to protect the subject, he flashed the background heavily with a green filter. Finally, using the positive mask, he made the step-and-repeat exposure series at far right.







Color Print Finishing

No matter how skillfully a photographer has posed his subject, how carefully the film has been exposed, or how technically perfect the color print has been made, the success of the final product depends to a large degree upon the operations of the print finisher. A few touches of the retouching brush will hide the inevitable stray hair, misplaced highlight, or unnoticed wrinkle. A spray of matte lacquer will mask all evidence of retouching, and the proper mount, mat, and frame will transform a color print into a valuable possession. Don't underestimate or neglect these final tasks of producing a photographic color print.

Print Retouching

Prints on KODAK EKTACHROME RC Paper, Type 1993, can be retouched in the same manner and with the same materials as KODAK EKTACOLOR RC Paper.

Most of the retouching required on a color print can be done with dyes, such as KODAK Retouching Colors, or with soft colored pencils. Other supplies suggested include a finely ground white opaque, KODAK PHOTO-FLO 200 Solution, a Winsor-Newton Brush, No. 0 or No. 2, KODAK EKTAPRINT R-5 or R-500 Stabilizer, anhydrous denatured alcohol, a supply of newsprint (low-grade absorbent paper), cotton, and a small ceramic palette.

Retouching Large Areas: Large areas of a print that require a color change or added density can be corrected by using KODAK Retouching Colors in a "dry-dye" technique. The technique has two major advantages: you can experiment until the desired effect is achieved before making the retouching permanent, and you can retouch F-surface color prints without losing the glossy finish.

The set of KODAK Retouching Colors, which consists of nine jars of colors (red, green, blue, cyan, magenta, yellow, orange, brown, and neutral), plus a jar of reducer, should be kept free of water if it is to be used in the dry-dye technique. Dyes containing water will tend to set when applied, making it difficult to remove excess or unwanted dye from the print. Any water-free dye can be removed readily by using the reducer or anhydrous denatured alcohol.

Prepare the print for retouching by thoroughly drying the emulsion surface. Then clean the surface to be retouched by buffing it with a tuft of clean, dry cotton. Avoid scratching the surface because the scratch will fill with dye and become accentuated.

To apply the dye, breathe on the cake of the retouching color to be used. Pick up a generous amount of dye by rubbing a tuft of dry cotton over the cake of dye. With a circular motion, transfer the dye from the cotton to the desired area of the print. Repeat this procedure if more color is needed. Smooth out the dye by buffing the area lightly with a clean tuft of dry cotton. Two dyes can be mixed over one area with this method. Dye on any overlapped area can be removed with reducer, applied in the same manner as the dye, or with anhydrous denatured alcohol. It is important to remove all remaining reducer by buffing the area with clean cotton.

To make the dye retouching permanent, subject the retouched area to steam for 5 to 10 seconds by holding the print about 10 inches from a steam source, such as a small electric vaporizer. When the surface marks caused by the dye application disappear, you have steamed the print sufficiently.

Steam-set colors cannot be removed with reducer or anhydrous alcohol. Most of the color can be removed, however, if undiluted KODAK PHOTO-FLO 200 Solution is applied to the area. Restrict the application of the PHOTO-FLO 200 Solution to the particular area, wait no longer than 1 minute, and then swab the area thoroughly with a fresh tuft of cotton moistened with a solution containing equal parts of water and EKTAPRINT R-5 or R-500 Stabilizer (working strength). Repeat this procedure, using fresh cotton; then allow the area to dry before resuming the retouching.

Retouching Small Areas: Use a separate set of KODAK Retouching Colors for spotting small areas of a color print (or remove a small quantity of dye from the jars to the palette with the point of a knife), because the addition of water will prevent the use of the dye set for dry-dye retouching. Moisten the dyes for spotting with a solution containing equal parts of water and KODAK EKTAPRINT R-5 or R-500 Stabilizer (mixed as directed on the package). Use a spotting brush to mix the desired dye color on the palette. Add a touch of neutral to the dye mixture; the neutral dye reduces the brilliance of the pure dye and improves the coverage of spotting. Keep the dilution weak for good control. Remove excess dye from the brush on blotting paper, moist cotton, or facial tissue; then spot-in the area, making sure that the dye is kept within the confines of the spot. If too much dye has been added, blot the area immediately with absorbent blotting paper.

Black Spots: Black spots on an Ektachrome print are usually due to dust on the transparency. Good darkroom housekeeping will eliminate the cause. Correction can be made by applying white opaque to the black spots on the print. When the opaque dries, apply colored pencils to match the color of the surrounding area. Or treat the black spots with opaque that has been tinted with the desired color. Spray the opaqued print with lacquer to restore even surface reflection.

Lacquers

Print lacquers can be applied to the surface of water-resistant paper prints to modify the sheen or to provide a variety of surface textures. You can use lacquers to provide protection from fingerprints or to act as a moisture barrier. The use of a lacquer will also prevent the emulsion of a print from sticking to glass or album sleeves. Since not all lacquers may be compatible with paper emulsions, be sure to use lacquers designed for photographic applications. Also, since formulations of lacquers may change, you should evaluate them occasionally according to your particular application.

Texturing

Unique surface textures can be applied to water-resistant paper prints by post-process embossing. Care must be taken to avoid cracking of the emulsion, which can shorten the life of the print. Cracks may be microscopic at first, but they may enlarge as the print ages. To minimize this problem, emboss with the minimum pressure necessary to achieve a satisfactory impression. Avoid texturing at low relative humidity and avoid deep, sharp texture patterns. For equipment, techniques, and service, contact equipment manufacturers or distributors.

Mounting

Prints on KODAK EKTACHROME RC Paper, Type 1993, can be mounted satisfactorily with KODAK Dry Mounting Tissue, Type 2. This tissue is coated on both sides with a thermoplastic resin which fuses both the mounting surface and the print with improved adhesion at lower temperatures and press times. The improved product can be used for mounting color and black-and-white prints that are on either a water-resistant or paper base. Follow the instructions carefully for successful results.

It is important to start with the dry mounting press set for the recommended temperature range and platen pressure:

Temperature Range: 82 to 99°C (180 to 210°F).
Platen Pressure: sufficient to bond the print, tissue, and mount together in firm contact.

Check the settings on the press occasionally to be sure they remain properly set.

For occasional work, if a press is not available, an automatic electric iron may be used. Start at the lowest temperature setting in the synthetic fabric range, and adjust the temperature as necessary. Since settings may vary, a test should be made to be sure that the iron is hot enough to activate the adhesive but not so hot as to scorch or blister the print.

Adhesives for Mounting: It may sometimes be desirable to use adhesives for mounting water-resistant paper prints on various materials such as mounting board, Masonite, and plywood. Whenever possible, the materials chosen should have a surface that provides good adhesion properties. When materials such as tempered Masonite are used, it may be necessary to roughen the surface with sandpaper to obtain good adhesion. There are many adhesives available.

Mounting on Nonporous Surfaces: Special considerations apply when prints are mounted on nonporous surfaces. Adhesives that depend on solvent evaporation do not work well, since the solvent cannot escape from between the mount and the print. In this case, it is necessary to use double-faced adhesive tape or a contact adhesive. An alternative approach is the use of a thermosetting adhesive, which depends upon heat to set the adhesive providing the final bond.

Marking or Back-Stamping the Base

Since a resin-coated base resists absorption, slow-drying inks should not be used for marking the backside of Ektachrome RC paper prints, because they will smear. Inks from most ball-point pens are satisfactory; fountain-pen inks are not.

For printing on the back of water-resistant paper prints with an offset press, it may be necessary to use inks modified for faster drying. It is suggested that you contact an ink manufacturer for a suitable formulation for the equipment to be used.

Caution: Be very careful to use only light pressure in marking the back of unprocessed paper. Excessive pressure will cause desensitization of the paper emulsion.

Laminating

Water-resistant paper prints can be laminated satisfactorily if pressures and temperatures are kept to a minimum. The temperature of the print being laminated must not exceed 104°C (220°F).

Troubleshooting

Processing variables can adversely affect the quality of prints on EKTACHROME RC Paper. Some of the more common causes underlying print-quality losses are contamination of solutions, lack of cleanliness, incorrect mixing of solutions, incorrect use of solutions, improper replenishment of solutions, inadequate washing, and lack of adequate control in the processing procedure.

When prints from good quality transparencies aren't everything you expect them to be, check the following troubleshooting charts for possible causes of unsatisfactory results.

General Sensitometric Problems

Effect on Paper		Possible Cause
Fast Photographic Speed: Low Density		First developer overreplenished or concentrated. Excessive time, or temperature too high in the first developer. Excessive agitation of the first developer in a 3½-gallon sink line or in a batch operation. Inadequate time, or low flow rate in the first water wash. Low temperature in the color developer and the succeeding solutions. Inadequate reversal exposure. First developer oxidized and color developer diluted. First developer contaminated with bleach-fix. Color developer contaminated with first developer. Color developer underreplenished.
Slow Photographic Speed: High Density		First developer underreplenished, exhausted, or diluted. Insufficient time or too low a temperature in the first developer. Inadequate agitation in the first developer in a 3½-gallon sink line or in a batch operation. First developer contaminated with stop bath. High temperature in the color developer and succeeding solutions.
Low Contrast	Low Cyan	Overdevelopment in the first developer (excessive time, temperature, or replenishment). Excessive agitation in the first developer for a 3½-gallon sink line or a batch operation. Light fog in the paper.
	Low Yellow	Poor recirculation (inadequate agitation) of color developer in a continuous process. Inadequate agitation in a 3½-gallon sink line or a batch operation. Color developer diluted. Insufficient time or low temperature in color developer.
	Low Overall	Excessive temperature in the color developer or succeeding solutions. Combination of overdevelopment in the first developer **and** diluted or exhausted color developer. Contamination of first developer or color developer with bleach-fix.
High Contrast	High Cyan	Underdevelopment in the first developer (insufficient time, low temperature, underreplenished, diluted, or exhausted). Poor recirculation (low agitation) of the first developer in a continuous process; inadequate agitation in a 3½-gallon sink line or in a batch operation.
	High Yellow	Color developer underreplenished.
	High Overall	Combination of first developer diluted **and** color developer oxidized.

Stain, Spots, and Physical Marks

Effect on Paper		Possible Cause
High Stain	Cyan Stain	Underdevelopment in the first developer (insufficient time, low temperature, or underreplenishment). Exhausted or underreplenished first developer. Poor recirculation (low agitation) of the first developer in continuous process; inadequate agitation in a 3½-gallon sink line or in a batch operation. Excessive time in the second water wash.
	High Yellow	Inadequate second water wash (short time or low flow rate).
	High Overall	First developer, stop bath, and color developer contaminated with bleach-fix.
Small Blue Spots (usually comet-shaped)		Bleach-fix coming in contact with the paper before the first developer stage.
Prussian Blue Spots		Iron contamination of the bleach.
Excessive Process Variability		Variations of time, temperature, or replenishment in first developer or color developer. Inadequate time or low flow rate in the first water wash.
Dirt Particles in the Emulsion		Dirt carried over from first water wash into the color developer and succeeding solutions. Inadequate wash times or clogged filters.
Contamination of Solutions (abnormal color, appearance)		Using mixing equipment not approved for photographic processing solutions. Bleach-fix contamination of the first developer, stop bath, color developer, or any of the water washes; replenisher storage tanks not having floating lids and dust covers. Interchanging of floating lids in replenisher storage tanks. Improper cleaning and rinsing of mixing equipment after preparation of each mix. In batch operations, improper cleaning of baskets, reels, hangers, etc. Interchanging of bottle tops or stoppers of replenisher solutions. Interchanging of floating lids in the processing tanks (working solutions).

Drum-Processing Difficulties (with KODAK Rapid Color Processor, Models 11 and 16-K)

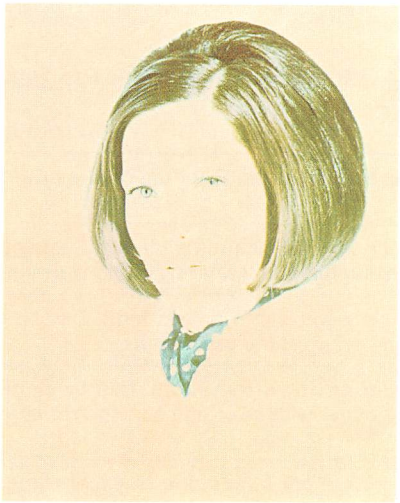
Problem	Probable Cause						
Drum does not wet evenly	Dirty drum	Drum not level	Processor tray not properly adjusted	Chemicals poured into tray too quickly	Wash water flow rate too high	Print not aligned properly on drum	Print not spaced properly from blanket bar
Drum stops rotating							
Print slides out							
Unprocessed or minus density spots							
One edge of print darker							

Prints by Garry Castelluzzo, processing demonstrations by Christine Hall.

Examples of Processing Errors

THE LARGE PRINT REPRESENTS NORMAL PROCESSING.

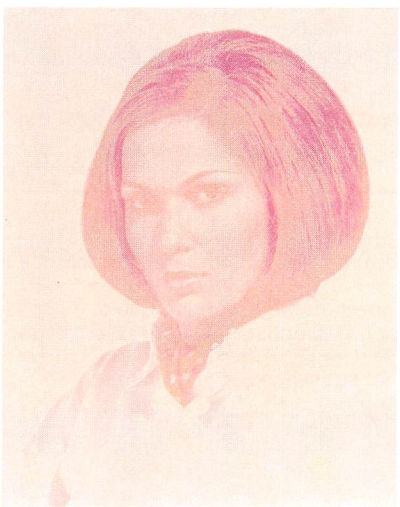
Low solution volumes.



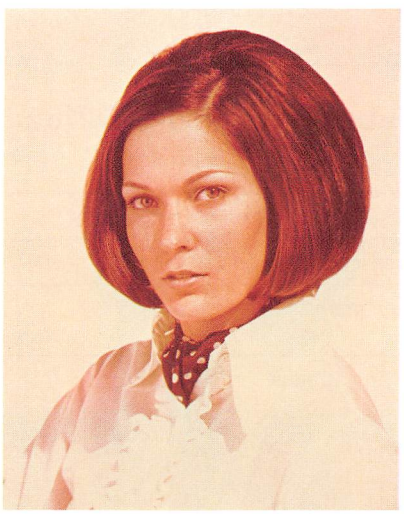
Bleach-fix contamination of the first developer (high level—0.5%).

Bleach-fix contamination of the first developer (low level—0.2%).

Bleach-fix contamination of the stop bath (about 1%).



Bleach-fix contamination of the color developer (high level—5%).



Bleach-fix contamination of the color developer (low level—0.5%).

◀ Diluted color developer. Caused by insufficient draining in the wash step preceding the color developer or by improper mixing of the color developer.

Diluted bleach-fix. Caused by insufficient draining in the wash step preceding the bleach-fix or by improper mixing of the bleach-fix. This effect can also be caused by using mixed bleach-fix that has been stored for a longer time than recommended. ▶

Drum-Processing Difficulties (with KODAK Rapid Color Processor, Models 11 and 16-K) *continued*

Problem	Probable Cause
Red color (minus cyan) near edges and extending into the print	Pressure from the blanket drag on the drum. Use a blanket the same width as the paper.
Red fingerprints and associated streaks	Handling with bare hands when positioning paper on blanket and lifting from prewet tray. Can be eliminated by wearing disposable vinyl gloves.
Streaks and air-bubble marks on any section of print	Incomplete wetting in prewet bath. Can be eliminated by increased agitation and/or increasing prewet time to 1 minute.
Pink marks along trailing edge and/or unprocessed corners on leading edge	Paper lifting away from drum. Can be eliminated by using a longer blanket, or by positioning paper with long side across drum during processing.
Wavy pink marks along trailing edge	Fluting of paper edges due to excess humidity in paper storage area. Keep paper in sealed package until needed.

Tube-Processing Difficulties (with KODAK Rapid Color Processor, Model 30)

Problem	Probable Cause
Unsatisfactory process uniformity	Check the level of the processor and the tube.
Excessive process variability	Check calibration of bath temperature; check solution temperature.
High stain	Solution containers contaminated; poor rinsing of processing tube, cover assembly, cover, and cover assembly cup; intermixing of solution containers.
Drying streaks	Print not squeegeed after stabilizer step.

Tube-Processing Difficulties (with small tube-type processors)

Problem	Probable Cause
Streaks or nonuniformity	Improper agitation: follow tube manufacturer's recommendations. Tube not level: check level during process. Solution poured into tube incorrectly: follow manufacturer's recommendations. Insufficient solution volume: use more of each solution.
Stain (overall or partial)	Contamination: use each container for one solution only; wash thermometer between solutions. Potassium iodide wash not used after color developer: follow the directions.
Weak color (not caused by exposure problem)	Insufficient drain time: be sure to drain the tube completely between steps.

Other Publications

This data book is necessarily limited to presenting information about printing color transparencies. The many ramifications of color photography can only be touched upon. Throughout these pages are references to other Kodak publications on specifically related subjects. Most of the publications are usually stocked by photo dealers. If your photo dealer does not have the publications you want, he can order them for you; or you can order them directly by using the order blank included with the *Index to Kodak Information.*

Published annually, the *Index to Kodak Information* lists more than 800 data books, Dataguides, and technical pamphlets covering topics from acetate films to zoological photography. Anyone with a serious interest in photography will find this index valuable indeed.

The Kodak library of practical photographic information stems from long-standing awareness that it is not enough to build quality into sensitized materials, chemicals, and equipment. Final results depend equally on the quality of the photographer's information. To put it another way, the quality of the product may be largely wasted if that product isn't used properly.

The *Index to Kodak Information,* Publication No. L-5, includes a self-mailing order form for the publications it lists. To get your complimentary copy, write to Eastman Kodak Company, Department 412-L, Rochester, New York 14650. Please include both title and code number (L-5).

Binder for Kodak Technical Information (W-4)

This deluxe binder will help scientists, professional photographers, industrial photographers, and many others to organize their collections of Kodak technical publications. From single-page data sheets to complete books, Kodak technical publications are all punched to fit this 1½-inch Mult-O-Ring binder. While primarily for publications of the 8½ x 11-inch size, the binder will also accommodate the smaller 5¾ x 8½-inch publications.

Included with the binder are 12 printed backbone strips to identify broad subject areas. These strips slip under the plastic cover on the backbone. Also included are 5 separators with blank index tabs to further organize areas of technical information. Inside the binder cover, a small pocket will hold a card with the owner's name and address. A special registration card allows the binder owner to send for the *Index to Kodak Information* and, wherever possible, for an appropriate Kodak periodical on photographic applications in his major field of interest. (See your photo dealer.)

Note: In Kodak photographic publications, products of other manufacturers are sometimes mentioned. Since any such product is subject to change beyond our control, we suggest that the user make his own tests (for safety, effectiveness, etc) and evaluate the product according to the particular application desired.

Professional
and Finishing
Markets Division

EASTMAN KODAK
COMPANY
ROCHESTER,
NEW YORK 14650

Printing Color Slides and Larger Transparencies
Kodak Publication No. E-96
CAT. No. 1317882

11-76-GE Minor Revision
Printed in the United States of America